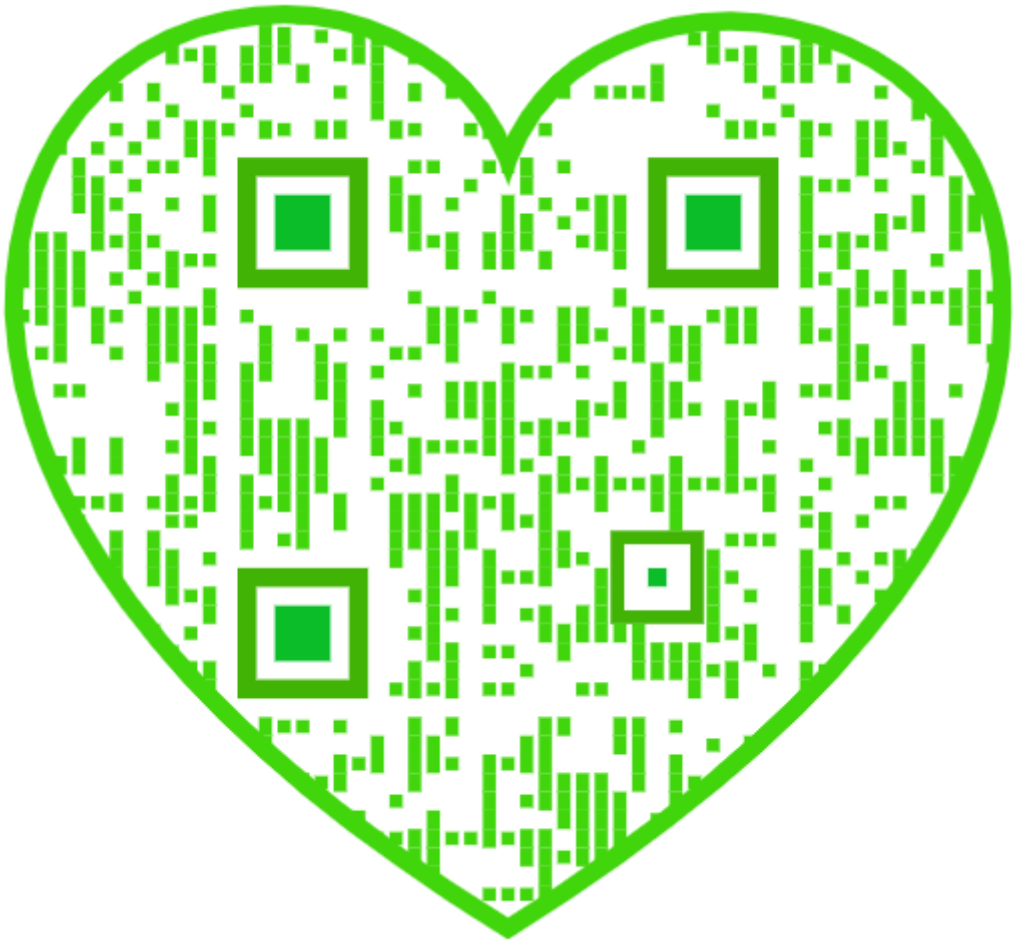
# METHOD IN READING AND NUMBER



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# METHOD IN

# Reading and Number.

BY

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# PREFACE.

These studies in method in reading and number are born of a desire to help the students in the writer's own classes in method in these subjects. There are many students who appreciate the necessity of the study of method in reading and number, and who are earnestly seeking help along the lines of a better method of teaching these subjects than that in use in many places. To give guidance to these students is the main idea which prompted to the preparation of these studies.

A second thought is, that many fellow teachers who have not had the time nor opportunity to make special studies in method in reading and number may receive help and guidance from these studies.

It is the aim of the present discussion (1) to investigate the theory aspect of method in reading and number in the light of the best educational thought of to-day; (2) to give an abundance of concrete illustrations of what these lessons should be in harmony with the theory; (3) to criticise existing practices in the teaching of reading and number which are thought to be bad. Thus the studies are *theoretical*, *practical*, and *critical*.

Simplicity and definiteness have been aimed at through the entire discussion to the end that direct help might be given to those who are beginning teachers in these subjects.

These studies are believed to be in harmony with the best educational thought of the present times.

So far as known no other *definite* and *simple* discussion of method in these subjects is in print.

G. W. N.

# CONTENTS.

## CHAPTER I.


GENERAL METHOD, - - - - 9–31

The Teaching Act, - - - - 9
The Processes in It, - - - 9
Nature of Method as a Subject, - - - 10–11
Classes of Method, - - - - 11
The Learner's Method, - - - - 11–13
The Teacher's Method, - - - 13–20
Method as a Physical Process, - - 20–25
Comparison of Teacher's and Pupil's Method, 29–30
Two Views of Method, - - - - 26–28
No Danger in Too Much Study of Method, - 29–30
Factors Determining Method, - - - 30–31


## CHAPTER II.


THE PURPOSE OF READING, - - - 32–38

General Meaning, - - - - - 32
Importance of Definite Idea of Purpose, - 32–33
Classes of Purposes, or Aims, - - 33
The Main, or Primary, Aim, - - 33–35
Evidence of Main Aim, - - - 35
Secondary, or Subordinate, Aim, - 36–37
Relation of These Aims, - - - 37
The Purpose of Reading and Literature, - 38


## CHAPTER III.


NATURE OF READING AS A SUBJECT, - 39–43

The School Curriculum, - - - - 39
The Language Group, - - - - - 39–40
The Subject-matter of Reading, - - - 41–42
Definition of Reading, - - - - 42–43


## CHAPTER IV.


PROCEDURE IN TEACHING READING, - 44–74

Stages of Reading, - - - - 44

The Preparatory Stage, - - - 44–45
The Stage of Reading Proper, - - 45–46
The Starting Point, - - - - 46
Basis, - - - - - - - 46–47
The First Unknown, - - - - 47

Methods of Beginning, - - - - 47–48
The Alphabet Method, - - - - 48–50
The Synthetic Method, - - - 50–54
The Sentence Method, - - - - 54–56
The Analytic Word Method, - - 56–57

Definite Procedure, - - - - - 57-60
Adjectives, and Action Words, - - 60
The, A, An, Is, Can, On, In, etc., - - 60–61
Fixing the Vocabulary in Mind, - - 61
Print and Script, - - - - - 62
Reading of Simple Pieces of Discourse, - 62–63
Analysis Work, - - - - 63–66
Working Out New Words as to Pronunciation, 66–68
Diacritical Marks, - - - - 68

Second Stage, - - - - - - 68–69
Didactic and Symbolic Discourse, - - 69–70
Steps in Symbolic Discourse, - - 70–72
Steps in Didactic Discourse, - - - 72–73

Summary, - - - - - - 73–74

## CHAPTER V.

CONCRETE ILLUSTRATIONS, - - 75–88

Advantage of, - - - - - 75
Excelsior, - - - - - - 75–79
Erastus Wren's Virtue, - - - - 80–81
The Golden Touch, - - - - - 82–86
Orchard Life, - - - - - - 87–88
Abou Ben Adhem, - - - - - 88

## CHAPTER VI.

COMMON ERRORS IN TEACHING READING, - 89–92

Opportunities for, - - - - - 89
The Use of the Alphabet Method, - - 89–90
Phonetic Work, or Sound Analysis, - - 90
Oral Reading to the Exclusion of Interpretation, 90–91
Lack of Thought Interpretation, - - 91
Indefinite, General Assignments, - - - 92

## CHAPTER VII.

SUPPLEMENTARY READING, - - - 93–98

Nature of, - - - - - - 93
Need and Value of, - - - - - 93
A Difficulty, - - - - - - 93
Lists of Books, - - - - - 94–98

## CHAPTER VIII.

NATURE AND ORIGIN OF NUMBER, - 99–106

Nature of Number, - - - - 99–101
Genesis of Number, - - - - - 101–102
Definition of Number, - - - - 102–103
Origin of Number, - - - - - 103
Limitation, - - - - - 103–105
Conclusions, - - - - - - 105–106

## CHAPTER IX.

METHOD OF PROCEDURE IN TEACHING NUMBER, 107–131

Points to Be Kept in Mind, - - - 107
Methods in Use, - - - - - 108
The Method of Symbols, - - - 108–109
The Fixed Unit Method, - - - 109–112
The Grube Method, - - - - 112–113
The Speer Method, - - - - 113–116
The Practical Method, - - - - 117
Two Stages of Number Work, - - - 117–118
Characteristics of Primary Stage, - - 118
Scope of Work in Primary Stage, - - 118–121
What Can Be Known of a Number, - - 121–124
What to Do with a Number in the Primary Stage, 124
The Number as a Whole, - - - 124
The One, the Measuring Unit, - - - 125–126
The Relations in the Number, - - 126–128
The Applications of a Number, - - - 128–130
Notation of the Number, - - - 130–131

## CHAPTER X.

METHOD OF PROCEDURE IN TEACHING NUMBER,—CONCLUDED, - - - 132–153

The Primary Stage, - - - - 132–135
The Number as a Whole, - - - - 135–136
The Relations in a Number, - - - 136–138

Thoroughness of Work, - - - - - 138–139
Fractional Relations, - - - - 139–141
Important and Unimportant Relations, - - 141–142
The General Applications, - - - - 142–144
Picturing Problems, - - - - 144–145
Notation, - - - - - - 145–150
Enumeration, - - - - - 150
The Multiplication Table, - - - - 150–152
Teachers' Helps, - - - - - 152–153

## CHAPTER XI.

PROCEDURE IN SECOND STAGE, - - 154–164

General Scope, - - - - - 154
The Formal Process of Addition, - - - 154–156
The Formal Process of Subtraction, - - - 156–159
The Formal Process of Multiplication, - - 159–161
The Formal Process of Division, - - 161–164
Conclusion, - - - - - - 164

## CHAPTER XII.

THE SUBJECT-MATTER AND PURPOSE OF NUMBER, 165–170

General Nature of Subject-matter, - - 165–166
The Purpose of Number, - - - - 166
The Knowledge-giving Purpose, - - 166–167
The Guidance the Knowledge of Number Gives, - - - - - 167–169
The Disciplinary Purpose, - - - 169–170
Conclusions, - - - - - - 170

## CHAPTER XIII.

COMMON ERRORS IN TEACHING NUMBER, - 171–179

Prevalence of, - - - - - 171–172
Wrong Number Concepts, - - - 172
Figures instead of Number, - - - 173
Unsystematic Number Teaching, - - 173–174
Teaching from the Form Side, - - - 174
Failure to Picture Problems, - - 174–175
Exhausting a Number, - - - - 175
Relations among Topics, - - - 175–176
Thoughts of Others, - - - - 176–179
Conclusion, - - - - - - 179

# CHAPTER I.

## GENERAL METHOD.

*The Teaching Act.*—The school exists as an organization in order that the most favorable conditions may be furnished for the act of teaching. It is in this act that the mind of the pupil comes into vital touch with the mind of the teacher. Here the miracle of the influence of one mind upon another is manifested. Here it is that an all-important duty of the teacher is involved. To this process all other processes of the school point. The school finds the idea that created it in the process of realization in the teaching act. The act of teaching is a process for it is a series of steps directed toward the accomplishment of an end. The teaching act is not a simple process for it is a large process made up of smaller processes.

*The Processes in It.*—A brief analysis of the teaching act will show that there are three processes going on in it,—(1) the thinking the learner is doing; (2) the thinking the teacher is doing; (3) a process of handling questions, directions, objects, assignments, and so on—the manipulation of means in teaching. The first two of these processes are spiritual, or mental,

processes, and the third is external to the minds of both the teacher and the pupil and is a physical process.

*Illustration.*—In teaching the definition of a noun to a student, first, the student's mind goes through the process of thinking (1) that the noun is a substantive word; and (2) that it expresses an object by naming it. This is the process in the mind of the student in the teaching act. Secondly, the teacher thinks these same points through with the student, but he thinks several other things, too. This is the spiritual process of the teacher in the teaching act. Thirdly, there is a process of asking questions, answering questions, illustrating, possibly referring to text-books, etc., going on, and this is the physical process in the teaching act.

*Nature of Method as a Subject of Study.*—The question, What is the subject of method like? is often asked. It may be answered in a general way by saying it is a subject of study the pursuit of which has for its special object to make teachers more skillful in teaching than they would be without such study. But this much might be said of any pedagogical study —of psychology, for instance. To be more definite, method as a subject is that study which deals with the three processes in the act of teaching as indicated above. These three processes in their various phases constitute the material of all study in the subject of method.

*The Subject-matter of Method.*—By subject-matter is meant the material of study in any subject or lesson. It is the thought and feeling embodied in any subject or lesson which are to be got from such subject or lesson by study. It always consists of facts and relations among such facts. So the subject-matter of method, as a subject of study, is the three processes, one in the mind of the learner, one in the mind of the teacher, and one a physical process, in their relation to the growth in the life of the learner.

*Definition of Method.*—Method is thus seen to be a complex and comprehensive thing. Any definition, to be perfectly accurate, must include the various phases of these three processes. The following, it seems, does this: *Method is the triple process in the act of teaching by which the learner is induced to take the steps from his real condition to a higher condition held up as an ideal.* This is the definition of method considered in its broadest and most comprehensive sense, and the sense in which its study will give the most help to the teacher.

*Classes of Method.*—Since there are three processes going on in the teaching act there are, in a sense, three methods,—the learner's method, the teacher's method, and physical method. These three will be studied somewhat in detail.

*The Learner's Method.*—The learner's method is the movement of his mind in gaining any point of

knowledge. The pupil's method is thus a living, spiritual process internal to his life. Method from this point of view is mental growth. That is to say, it is the change of potential mental activity into actual mental activity, and this is the essence of growth.

*Illustration.*—If the child learns in a number lesson that 8+7=15, the activity of his mind in thinking the following steps is his method:—(1) The mind rethinks the number 8; (2) the mind rethinks the number 7; (3) the mind thinks the number 8 and the number 7 together; (4) the mind thinks the name of the new number. These four steps are the mind's process in thinking the point of knowledge, and are, therefore, the mind's method. This phase of method calls attention to the fact that the thing to be watched and emphasized in teaching is the change in the learner's life by which he is constantly rising to a higher plane of living.

*Definition of the Learner's Method.*—This phase of method may be characterized by the following definitions:—

1. Method is the process in the learner's mind in thinking a thing.

2. Method is the movement by which the mind of the learner identifies itself with the thought and feeling of the external world. The external world here means anything external to the mind of the learner.

3. Method is the mental activity in which the

mind makes the objective the subjective. The objective means the external world, and the subjective means the self. And the self means one's original capacity to know, to feel, and to will, plus the effect of experiences on this power.

4. Method is the process by which the mind of the learner goes from its real condition to an ideal condition. One's real condition is his condition just as he is at any time. His ideal condition is one different from what he is in at any time, and which actually has no existence except as an idea in the mind; hence the name *ideal*. The ideal condition is not necessarily a better condition than the real, but may be either a better or worse condition.

*The Teacher's Method.*—The part the teacher performs in the process of teaching is a very important topic of study in the subject of method. This must be thoroughly understood by one who is to succeed best. To study this is to study the teacher's method. And to this we turn.

First, the teacher must think the thought in the point or points to be taught; that is, he must think the *subject-matter*. Secondly, he must see in terms of development of the learner's life the reasons for teaching the subject-matter; that is, he must see the *purpose*. Thirdly, the teacher must see the nearest related knowledge possessed by the learner which he can use as a foundation to build upon in teaching the new point; that is, he must see the *basis*. Fourthly,

the teacher must see the activities the learner's mind puts forth in mastering the points of truth in the subject-matter; that is, he must see the *steps*. Lastly, the teacher must see the means he may best employ in leading the mind of the learner to take the steps in mastering the subject-matter; that is, the teacher must think out the *devices*. Thus the teacher in teaching a lesson must think (1) the subject-matter; (2) the purpose; (3) the basis; (4) the steps; and (5) the devices. These five things every teacher does in some sort of way in teaching every lesson. Some think them out clearly and accurately, and some think them out scarcely at all, and do not know that they do even that much. A teacher can think the teaching of a single point, or of a whole lesson, or of a whole subject, under these five heads, and must do so with more or less accuracy in teaching. It is worth our while to study these five points further for the help the study will give.

*Subject-matter.*—In a general way the subject-matter is that which is to be mastered by study. It is the thought embodied in the thing studied by the mind of the learner. In a particular lesson the subject-matter is just that to be got from the lesson which the learner should have after the recitation. In a particular subject, as grammar or history, the subject-matter is just that to be got from the subject which the learner should be in possession of after the study of the subject. In this general sense the sub-

ject-matter of education is the whole world of thought. This study is too general to be very helpful. A closer study will reveal the fact that every subject-matter is composed of two things: 1. The facts to be taught or to be studied. 2. The relation in which these facts are to be taught or studied.

*Illustration.*—Suppose the words, *inquiry*, *discourse*, and *aspirant* are to be taught. Now, a spelling lesson might be made of it; and if it were a spelling lesson, the subject-matter would be, the words, *inquiry*, *discourse*, and *aspirant*, as to their correct written or printed forms. Thus the words *inquiry*, *discourse*, and *aspirant* are the facts to be taught or studied, and "as to their written or printed form" indicates the relation in which they are to be taught or studied. But these same facts might be used, and the lesson not be a spelling lesson at all. If the relation they are to be studied or taught in is as to their correct pronunciation the lesson would be one in orthoepy, and the subject-matter would be, the words, *inquiry*, *discourse*, and *aspirant* as to their correct pronunciation.

*Further Illustration.*—Suppose the facts of the revolution of the earth around the sun are taught, who can say whether the lesson is one in astronomy or one in geography? If, however, these are taught in their relation to the distribution of life, climate and relief forms on the earth's surface, the lesson at once reveals itself as a geography lesson. From

these illustrations it is to be seen that a subject-matter consists of (1) the facts to be taught or studied; and (2) the relation in which these facts are to be considered. This relation is often called the organizing principle of the subject-matter.

*General Statement of Subject-matter.*—The statement of a subject-matter is not the subject-matter any more than a word is an idea, or a sentence a thought. The statement of the subject-matter bears the same relation to the subject-matter that the word bears to the idea and that the sentence bears to the thought; that is, the statement bears the same relation to the subject-matter that the symbol does to the thing symbolized.

The general statement of a subject-matter is very valuable to a teacher, whether it be of a single lesson, or of a whole subject. It is helpful to the teacher because it must do two things: (1) it must name the facts to be taught, and (2) it must tell the relation in which these facts are to be taught. Thus the general statement of the subject-matter of any subject is a perennial guide to the teacher in teaching that subject, in that it shows, in a general way, what to teach and in what relation (how) to teach it.

*Purpose.*—Purpose in reality is beginning and end in every process. The purpose as idea—the beginning—moves forward in the process to its realization—the end. The purpose exists in the teacher's mind, but is to be realized in the life of the learner.

The purpose is the effect the mastery of the subject-matter should have on the life of the child. In actual teaching the teacher is to go from the subject-matter by way of comparison with the effect the thinking the subject-matter has on his own mind to its effect on the child's life, which is the purpose. That is to say, there is no way to tell the purpose of any subject-matter except from the effect its mastery produces on the child's life. The course of study—the subject-matter—is usually provided for the teacher. So the teacher must start with the subject-matter and find out the purpose in teaching it. Much depends in the teaching act upon how well the teacher does this. If the teacher has definitely in mind just what he wants to do in the lesson he will be drawn steadily and constantly toward its accomplishment. A definite purpose saves time, economizes energy, emphasizes the important, organizes, and prevents aimless wandering.

It will be seen that in teaching any lesson there are two phases of the purpose: (1) To give knowledge valuable for guidance in living; (2) to give mental discipline; that is, to furnish a mental gymnastic to the end that the mind may grow strong by exercising it.

*Basis.*—This is the learner's nearest related knowledge to the new points to be taught, and upon which the teacher may build in teaching the new point. Basis is an important point in teaching. Many errors are made in teaching because the learner has

not basis for learning the new point, or because the teacher does not see the basis. Teaching in harmony with the principle underlying basis, *the mind naturally goes to the unknown from the nearest related known*, means a progressive development of a subject, each step becoming basis for the step succeeding it. There are many violations of basis in teaching, as often done.

*Illustration.*—If the lesson to be taught is that 5+4=9, the child must know the number 5 and the number 4 as basis before he could learn that 5+4=9. If the teacher should attempt to teach this lesson without having taught the numbers 5 and 4 he would meet with the difficulty of insufficient basis. Again, if a teacher attempts to teach the noun to a class without the class having a definite knowledge of an object, he will most surely meet a difficulty in the basis. The teacher to teach well must see and choose definitely his basis.

*Steps.*—Steps are more or less complete movements of the mind. They are mental things and in the teaching act are in the life of the learner. They are the advances of the mind in mastering the separate points of the lesson to be learned. Or in a more general sense they are the advances of the mind in mastering the various phases of a subject.

*Illustration.*—If the lesson to be taught were that 17—8=9, the steps would be: 1. The advance of the mind in rethinking the number 17. 2. The advance of

the mind in rethinking the number 8. 3. The advance of the mind in thinking the number 8 away from 17. 4. The advance of the mind in thinking the number 9 as remainder. Again, if the lesson were to teach the definition of the triangle, after examining several triangles, the steps would be: 1. The advance of the mind in thinking that a triangle is a figure. 2. The advance of the mind in thinking a triangle has three sides. 3. The advance of the mind in thinking a triangle has three angles. 4. The advance of the mind in synthesizing these points into the definition, *A triangle is a figure having three sides and three angles.*

To know the steps the mind takes in working out any new lesson is a matter of much importance to the teacher. He must know something of the steps or he can not teach at all; and, other things equal, the more clearly the teacher has thought the steps, the better will he teach the lesson.

*Devices.*—The devices are the various things used by the teacher to lead the mind of the learner to think and feel in the manner desired. A synonym for devices is the term *means.* Devices, or means, constitute a very important factor in teaching. There is opportunity for the exercise of rare judgment, tact and skill in the selection of devices. When it is understood that questions, text-books, and reference books; maps, globes, and school apparatus in general; blocks, sticks, etc., are devices in teaching, some-

thing of their importance in school work becomes evident. Devices are so important that among many, method means nothing more than the manipulation of devices. However important they are it must not be lost sight of that they are always determined in the light of the mental process they are to induce. They are means to an end, and in nature the end is always more important than the means.

*Method as a Physical Process.*—It is, perhaps, using the term *method* in its most popular significance to think of it as meaning some physical process external to the life of the learner. That is to say, it is using the term in the sense in which most persons commonly use it in speaking and writing. This idea of method is the one usually held by persons who have not made a careful study of what the term really ought to mean. There is a sort of indefiniteness in the minds of most of such persons as to just what they do mean by method. However, upon examination it will be found usually that the idea that method is the manner of doing some physical thing prevails, though even this is held in mind more or less vaguely. From thinking of method in this sense we have the following terms:—"Object Method," "Concert Method," "Consecutive Method," "Promiscuous Method," "Catechetic Method," "Lecture Method," "Socratic Method," and "Laboratory Method."

These all refer to the manipulation of objects,

questions, and answers in the teaching act, and so are to be studied briefly under method as a physical process.

*The Object Method.*—By this is meant the handling of objects by teacher and pupils in the process of learning. It is a good line of work, if used judiciously. It has its proper place in teaching number work, primary reading, nature work, primary geography, and primary language.

*The Concert Method.*—The concert method means having students to answer questions, read, and speak simultaneously in the recitation. There is much that may be said against concert work, but very little to be said for it. It is objectionable because it (1) violates the law of self activity; (2) stifles individual effort and individual responsibility; (3) does not bring out clear, definite answers or thinking; and (4) leads to confusion, disorder, and chaotic class work. There may possibly be instances in which concert work may be used advantageously, but as a rule it should be avoided.

*The Consecutive Method.*—The consecutive method of asking and answering in the recitation means beginning at some point, the head of the class, or at the name beginning with *A*, and proceeding in some regular order back to the point of starting. In proceeding in recitation this way the students know pretty well when the "turn" of each one will come. This method, like the preceding one, has many things

against it, but little to recommend it. It is objectionable because it leads to (1) habits of inattention; (2) disorder and disorganization of the class; (3) habits of idleness; and (4) bad methods of study. However good a student may be, if, when he has answered a question, he knows to a certainty that he will not be called upon again for some time, the tendency is for him to relax his attention. If the student is not a good one, the tendency in this kind of work is for him to become worse, and since he is not called upon to attend closely he is prone to do something else, thereby causing disorder and disorganization. Idleness in the class is a direct result of inattention, and bad habits of study result from the student's being able to prepare just those points in the lesson which he has reckoned will come to him.

*Promiscuous Work.*—The promiscuous method of asking questions and receiving answers refers to distributing the questions and receiving answers from students promiscuously. No student knows to whom the answer to the question will fall. This method unlike the two preceding has much to be said for it and little or nothing against it. It is desirable because (1) it fosters habits of attention and concentration; (2) it is flexible and gives the teacher the best opportunities for meeting the needs of individual students; (3) it fosters habits of order and organization in the class work; and (4) it tends to industrious habits, and right methods of study. By the use of

the promiscuous method students are held constantly to attending to the question under consideration, to the careful preparation of the lesson as a whole, and to order and unity in the class. As a rule, the promiscuous method is certainly the best for class work.

*Catechetic Method.*—This is, in its original form, not much used any more, and so needs very little said about it. According to this method the question was written in the text-book and just after the question was the answer to it. The student's business was to read the question, and then commit to memory the answer. In the recitation the teacher with text-book in hand read the question and the student gave, in the words of the text, the answer. Such a manner of conducting a recitation has nothing to recommend it and so needs no further study.

*Lecture Method.*—The lecture method refers to teaching by means of talks or lectures. This method, perhaps, has its advantages and disadvantages. It is certainly not adapted to all kinds of school work, and probably not adapted to any kind of school work if used exclusively. There are, however, some phases of school work which may be profitably taught by talks, or lectures. To elementary school work the lecture method is not at all adapted, and but very poorly adapted to secondary school work. In the first eight years of the child's school life he must be taught differently than by this method. That stays with the child which he has an opportunity to see, hear, and

think about. This, however, is not to be construed to mean that oral teaching should not be done in primary history, primary geography, nature work, etc. If the lecture method has any legitimate place in school work it is in the college and university. However it may seem theoretically, it remains as a fact that those things which are digged out by the student, recited upon in the class, and discussed by questions and answers are the things which in the end stay with him and do him good. Certainly the lecture method in the average teacher's school work is, to say the least, to be used sparingly, and with much caution when used at all.

*The Socratic Method.*—This method takes its name from Socrates a Greek philosopher and teacher born 469 B. C. It is sometimes called the developing method. It proceeds by the employment of subtle questions to lead the student to think what it is desired for him to think without telling him anything. "The Socratic method, more or less perfectly understood, has had great influence upon professional pedagogy. In many schools for the professional training of teachers, and in many schools in charge of teachers professionally trained, systematic questioning of this sort is looked upon as ideal teaching; and there is no lack of conscientious endeavor to prepare for use in recitation, series of questions which shall lead the child's mind to take the logical steps which given occasion requires. One who doubts the value of such

systematic questioning may usually be converted by hearing a single typical recitation conducted by a master of the art. The power of such a recitation to touch, move, chasten and direct the soul is so evident, that if Socrates and Plato had taught us nothing but how to do such work their fame as teachers would be justified." It is noteworthy that the "Socratic Method" is diametrically opposed to the "Lecture Method."

*The Laboratory Method.*—This is also often called the "Scientific Method," and it means a procedure in which the student is lead to investigate and think for himself. It is opposed to taking things on mere authority without investigation, and to the text-book method. It proceeds by leading the student to deal with the actual material of study rather than to deal with what some one has said about it. In botany, studied in this way, the student deals with plants; in zoology, with animals; in grammar, with sentences and parts of sentences. This method has much to recommend it. 1. It fosters habits of free inquiry and free investigation. 2. It is the mind's natural way of learning. 3. It makes the student self-directive and self-helpful. 4. It fixes with the student right methods of study. 5. It gives the student a critical attitude of mind. All these are very desirable characteristics for a student to have.

*Comparison of Teacher's and Pupil's Method.*—These two methods are alike as follows: 1. They are both

spiritual processes. 2. The mind of the learner and the mind of the teacher go through the same process in thinking the thing to be learned. 3. Both the teacher and the pupil keep in mind to some extent the purpose of the process in the teaching act.

These two methods are different as follows: 1. The teacher, in addition to thinking the truths to be learned, must think the learner's thinking of them. 2. The teacher must think out the means or devices to be used in leading the learner to think the desired points of truth. 3. While both the teacher and pupil keep in mind the purpose, the teacher sees it definitely, or should do so, while the pupil only sees it vaguely. The teacher's method thus includes more than the learner's.

*Two Views of Method.*—The foregoing study suggests to us that there are two views of method. It is unfortunate that educational writers hold these two views, as considerable confusion prevails because of this fact. One class of educators, those who have studied method least, mean by method simply the physical process in the act of teaching. A second class, those who have been special students of method, mean by method the triple process in the act of teaching.

*Comparison of the Two Views.*—In our study of method we may call these two views respectively the *popular view* and the *special view*. The popular view will thus designate method as the manipulation of

external means, or devices, and the special view will designate method as the triple process.

Thinking of method according to the popular view constantly places the mind's emphasis upon something external to the life of the learner. This has in the past led to much that was bad in teaching and is still doing so. The teacher loses sight thus of the fact that it is in the learner's life that the educating process is to be carried on. He is prone to make the manipulating, the text-book, or some petty scheme of teaching an end instead of a means. Every question that arises concerning teaching must be settled in the light of the effect upon the life of the learner. The ultimate question is, How does it affect the life of the learner? The process in which the mind of the learner masters the new point of knowledge is the point of prime importance in the teaching act and the thing always to be emphasized in the study of the act of teaching. The popular view of method leads to almost hopeless confusion. Everyone holding this view who happens to use some different device, or means in teaching calls it his method and gives it a name. Since there is an almost infinite number of devices which may be used, there thus arises an almost infinite number of methods, which no teacher can or desires to keep informed upon. This leads to a hopelessly chaotic condition of things in the study of method.

The popular view of method has led to much dis-

paragement of the study of method among persons who should be friendly to its study. These are oftentimes persons who are very good thinkers, but who have not given special study to method. It is a common remark among this class of teachers that one may study method in a subject at the expense of a knowledge of that subject. The depreciating remarks made about method, which arise from the popular view of method, are a source of much harm to the profession of teaching. This is true, because many persons who would otherwise make a careful study of method and would receive the benefit that must come to the teacher thereby, are kept from beginning the study by this disparaging attitude on the part of some teachers. It may be safely said that there is need for no one thing among teachers more than an intensely professional spirit. It seems strange that some teachers take pleasure in saying depreciating things about method work. It is, however, probably to be explained from a misconception of method. I have never yet heard the first person speak depreciatingly of method, who had been a student of the subject.

The special view may be proven to be the better view. This is the argument: A thing is good accordingly as it realizes the purpose which brought it into existence. Method as a subject came into existence to supply the want for something, the study of which would help the teacher to do better work in his daily

teaching. Accordingly, that thing whose study helps the teacher most is the best. It has already been shown that the study of method as a triple process is more helpful to the teacher than the study of method as the manner of manipulating some external means or device. Therefore, the special view is the better view of method.

*No Danger in Too Much Study.*—It is not difficult to see that there is no danger of a teacher's devoting too much time to the study of method when one takes the proper view of method. The teacher can not study the process through which the mind goes in mastering any point of knowledge until he has the knowledge himself. For instance, the teacher can not see the mental steps the mind of the learner takes in learning the definition of an adjective without knowing the definition of an adjective himself. To know the method in teaching the definition of an adjective is to know two things: 1. The definition of an adjective. 2. The process the mind naturally employs in learning the definition of an adjective. No teacher can rationally and well teach the adjective who does not know these two things.

*Further Illustration.*—In the teaching of history this point becomes quite evident. The teacher who knows method in history knows these two things: 1. The events of mankind in their relation to the struggle of the race for freedom. That is to say, he must know history. 2. The natural processes of the mind

in learning history. No teacher can teach history at all without a knowledge of the first, and it is equally clear to any person who will think, that no one can teach history well without a knowledge of the second.

So this question reduces itself to the following: It is not possible for a teacher to study method too much, unless it is possible for a teacher to know too much about his subjects and to know too well the mind's natural process in learning those subjects.

*Factors Determining Method.*—Nearly twenty years ago one of our foremost educators said, 'The law in the mind and the thought in the thing studied determine the method.' This statement can not well be improved upon. And it reveals the two factors which determine method. They are (1) the law in the mind; (2) the thought in the thing studied. It is to be noticed that it is the law of the mind; that is, the general truths of mental activity—the forms of activity common to all minds. Each mind has individual traits, but in general, all minds act in the same way. The laws of mind are the forms of activity common to all minds. Each thing is the embodiment of thought. That is to say, each thing expresses thought. Longfellow's "Evangeline," the ink-stand, the maple tree is each the embodiment of thought.

*Illustration.*—Holding in mind that method is the mind's process of learning, we can readily see that the process is different in learning things much alike. The activity the mind puts forth in learning the def-

inition for the noun is very different from that put forth in getting the thought and feeling from Tennyson's "Bugle Song." One cause of the difference is, that there is a great difference in the thought embodied in the two things. This illustrates that the thought in the thing studied is a factor in determining the method. Again, a child of six could not under any set of circumstances solve a difficult geometry problem because it would violate the laws of his mind. He could on the other hand learn that the printed word *hat* represents the idea hat. Thus in this case the law of the mind would determine the method.

This whole study of method should emphasize the truth that the essential thing in teaching is opening up the way for the realization of the child's inherent possibilities.

> "Truth is within ourselves; it takes no rise
> From outward things, whate'er you may believe.
> There is an inmost center in us all,
> Where truth abides in fullness, and around,
> Wall upon wall, the gross flesh hems it in,
> * * * * * * And to know
> Rather consists in opening out a way
> Whence the imprisoned splendor may escape,
> Than in effecting entry for a light
> Supposed to be without."

## CHAPTER II.

### THE PURPOSE OF READING.

*General Meaning.*—It will be remembered that the purpose of any subject means the effect the pursuit of that subject has on the life of the learner. It is, of course, true that the pursuit of any subject will produce different effects upon different pupils depending upon the method in which the subject is pursued together with the individual differences of the students. But it remains that the purpose is to be determined by the effect produced in the mind of the learner. Thus in general we may say the purpose of reading as a school subject is the effect the proper pursuit of reading will produce in the life of the learner.

*Importance of Definite Idea of Purpose.*—Purpose is both beginning and end in every process of teaching. It is beginning as an idea in the mind of the teacher, and it guides the process in its movement forward to its realization in the life of the child, the end. It is of first importance to the teacher to have clearly and definitely in mind the purpose of any subject before starting to teach it. And the evidence of this truth is that the purpose will determine:

1. The character of the teaching process.
2. The means used in the teaching process.
3. The end reached by the teaching process.

A clear, definite, fervent purpose will draw the teacher in teaching towards its accomplishment as surely as the earth draws all things toward its center. A clear, definite purpose saves loss of time, dissipation of energy, and disorganized, scrappy teaching.

*Classes of Purposes, or Aims.*—For the purpose of helping ourselves in the study we may classify the aims of reading into (1) the main, or primary, aim; and (2) the secondary, or subordinate, aim. What is true of reading concerning its purpose is also true of any school subject. That is to say, the pursuit of every school subject affects the life of the learner in various ways, but the effects usually are divisible into predominant and subordinate classes.

*The Main, or Primary, Aim.*—There are three language units,—the *word*, the *sentence*, and *discourse*. They had their origin as follows: The word was born of a desire to express an idea; the sentence was born of a desire to express a thought, and discourse was born of a desire to express a series of coherent thoughts. Thus the work the word has to do is to symbolize an idea; the work the sentence has to do is to symbolize a thought, and the work discourse has to do is to symbolize a series of coherent, or connected, thoughts.

The subject of reading deals with discourse as

its language unit. Reading, of course, deals with the word and the sentence, too, but not as an end. It deals with them as a part of discourse, and as a means to discourse as the end.

In teaching reading the most important thing to be done is to lead the learner into gaining the ability of getting the thought and feeling symbolized by pieces of printed and written discourse. And this is called *interpreting* discourse, or *interpretation* of discourse. Thus the main aim of reading may be stated as follows: The main aim of reading as a subject is *to give the learner skill in the interpretation of discourse in order that he may come into the possession of the thought and feeling of the race as embodied in history, literature and science.*

There are two points in this statement for the main purpose of reading which need special notice. First, reading is to give *skill* in interpretation. This means the ability to interpret readily and accurately. It is not sufficient that the learner can interpret discourse. The world needs people who not only can do something, but who can do it readily and accurately, and this will be just the requirement in reading during the learner's life. So skill in interpretation is the thing to be aimed at—the ability to interpret rightly and quickly. Secondly, the experience of the human race is the heritage which it has left to each learner, and he needs to have skill in interpretation that he may come into his own birthright. This is

true for this experience of the race is recorded in history, literature, and science. He wants to interpret recorded history in order to come into the experience of the race in its actual struggle for higher life. He wants to interpret literature in order to come into the experience of the race in the ideal struggle for higher life. He wants to interpret science in order that he may learn the laws of life as well as the great truths and forces of nature to the end of conforming his actions to the highest welfare of his own being, and to the lives of others.

*Evidence of the Main Aim.*—The question, Why is skill in interpretation to be considered the main aim in reading? may be asked. The answer to this question is as follows: All education is to prepare the learner for the duties of life. The pursuit of reading is a part of the educational process, and should thus contribute its part in the process of education. The reading the learner will be called upon to do in life is predominantly *silent reading;* that is, *interpretation of discourse.* It is fair to say that seventy-five per cent. of the reading the learner will want to do through life will be merely the interpretation of discourse—the silent reading of the daily paper, magazines, works of fiction, works of science, literature, catalogues, schedules, etc. So skill in getting the thought from these various kinds of discourse will be his greatest need which the subject of reading can supply, and since this is the greatest need to be supplied, the

main aim of reading is *to give skill in the interpretation of discourse.*

*Secondary, or Subordinate, Aim.*—But to give skill in discourse interpretation is not the only aim of reading. Reading as a subject comprehends the oral expression of the thought and feeling embodied in discourse, and it is the aim of the pursuit of reading as a subject to make the learner skillful in this also. So the subordinate aim of reading as a subject may be stated as follows: *The subordinate aim of reading is to give the learner skill in the adequate oral communication, in the author's own words, of the thought and feeling symbolized by discourse.* It is to be noted that the author's own words are to be employed in the oral expression, otherwise we do not regard it as oral reading. If one should get well in mind the thought and feeling embodied in a piece of discourse, he might communicate this thought and feeling in his own language instead of the language of the author, but it could not be called oral reading. The purpose, or aim, of reading may be summed up as follows:

$1^1$. Purpose of reading as a subject.

$1^2$. Main, or primary, purpose.

$1^3$. To give the learner skill in the interpretation of discourse in order that he may come into the possession of the thought and feeling of the race as embodied in history, literature, and science.

$2^2$. Secondary, or subordinate, purpose.

1[3]. To give the learner skill in the adequate oral expression, in the author's own words, of the thought and feeling embodied in discourse.

*Relation of These Aims.*—While these aims are both important in reading, the aim as to oral reading —the adequate communication of the thought and feeling in the author's own words—must be subordinated to the aim as to skill in interpretation. This is true for two reasons. First, it is worth much more to the learner in life to be able to get readily and accurately the thought and feeling from all kinds of discourse than to read well orally. Secondly, correct interpretation precedes and is fundamental to correct oral reading. It is self-evident that the learner can not adequately communicate the thought and feeling embodied in discourse when he has not come into possession of that thought and feeling. Skill in oral reading presupposes skill in interpretation. There is no surer way for a teacher to fail in obtaining good oral expression than by fixing his eye upon the oral expression to such an extent that he loses sight of the importance of interpretation and so slights it. Mistakes in oral expression usually have their origin in mistakes in interpretation. Some have even thought that if a student has the thought and feeling embodied in the selection, he will *always* read it well orally. But this probably puts it too strong, though it certainly is true that the student will generally read well orally, if the interpretation has been well done.

*The Purposes of Reading and Literature.*—The question for study here is, Are the purposes of reading as a subject and of literature as a subject different in any way, and if different, how? A little careful thinking on this point will show us that the purpose of reading as a subject is as different from the purpose of literature as a subject as the purpose of reading is different from the purpose of history. In fact they differ in very much the same way, and the difference is this: reading has for its purpose to give skill in interpretation, also in oral communication, while literature has for its purpose to affect the life of the learner by means of the thought and feeling embodied in the literature. In reading the learner reads in order that he may become skillful in reading, while in literature the uplift given by the thought and feeling in the selections studied is the aim. It is not the main aim of literature as a subject of study to give skill in interpretation and in oral communication, while in reading as a subject this should always be the main thing aimed at. Thus the aims of reading and literature as subjects are not at all identical.

## CHAPTER III.

### NATURE OF READING AS A SUBJECT.

*The School Curriculum.*—The school curriculum is the school course of study. It is made up of the various school subjects; as arithmetic, history, grammar, reading, spelling, geography, etc. The subjects in the school curriculum as a whole may be conveniently divided into groups, as follows: 1. The language group consisting of reading, writing, spelling, orthoepy, etymology, lexicology, grammar, literature, composition, rhetoric, and primary language. 2. The mathematical group consisting of arithmetic, algebra, geometry, trigonometry, calculus and surveying. 3. The natural science group consisting of physiology, botany, zoology, psychology, chemistry, physics, astronomy, geography and geology. 4. The history group consisting of United States history, English history, and general history. 5. The art group consisting of drawing and music.

*The Language Group.*—The language group is a group of subjects which have, in general, for their subject-matter language as a medium for communicating thought. As it was seen in previous study there are three language units,—the *word*, the *sen-*

*tence*, and *discourse*. Some of the subjects in the language group deal with the word as their language unit and thus are known as word studies; one deals with the sentence as its language unit and thus is known as a sentence study; and some which deal with discourse as their language unit are known as discourse studies. The word studies are spelling, orthoepy, etymology and lexicology. Spelling is that word study which treats of the correct form of the written or printed word. Orthoepy is that word study which treats of the correct pronunciation of words. Etymology is that word study which treats of the derivation of words. Lexicology is that word study which treats of the meaning of words.

The sentence study is grammar. And grammar may in general be defined as that language subject which deals with the sentence as an instrument in communicating thought.

The discourse studies are reading, literature, rhetoric, composition and primary language. Reading, literature, and rhetoric as the science of discourse, deal with discourse as a finished product, while composition and primary language deal with discourse in the process of construction—as unfinished.

The following diagram will reveal the relation among the language subjects in the language group:

- Language Units
  - The Word
    - Spelling.
    - Orthoepy.
    - Etymology.
    - Lexicology.
  - The Sentence — Grammar.
  - Discourse
    - Finished
      - Reading.
      - Literature.
      - Rhetoric.
    - Unfinished
      - Composition.
      - Primary Language.

*The Subject-matter of Reading.*—It will be recalled that every subject-matter consists of two things,—*facts* and the *relation* in which these facts are to be considered. Then these two things are to be found in the subject-matter of reading. Now the facts to be dealt with in reading are facts of discourse. That is to say, reading as a subject deals with pieces of discourse. And it deals with discourse in two ways: (1) as to its interpretation; (2) as to the oral expression of the thought and feeling which the discourse symbolizes, this expression to be in the author's own words. By *interpretation* is meant getting the thought and feeling the discourse symbolizes. While the oral expression is important, it must not be lost sight of that interpretation must come first in importance as well as first in time. Interpretation is fundamental to oral expression and is presupposed by oral expression. There is no such thing as adequate oral expression without good interpretation.

The following is the formal statement for the subject-matter of reading: *The subject-matter of read-*

*ing is discourse primarily as to its interpretation and secondarily as to the adequate oral expression of its thought and feeling in the author's own words.*

This statement for the subject-matter of reading is a constant guide to the teacher who gets it well in mind. This is true because it tells him what to teach and the relation in which to teach it; that is, *how*, in general, to teach it.

*Definition of Reading.*—The main thing in reading is getting the thought and feeling which discourse symbolizes. This is sometimes called *silent reading.* It matters not what it is called, if teachers see that it is the important thing in reading, and thus, is the thing to be emphasized. Oral expression is important, but not so important as getting thought, because the learner will not use it more than one-tenth as much in life as he will use his ability to interpret.

Reading is a discourse study. And it is the discourse study which deals with discourse in the two ways often indicated in these studies. The formal definition of reading is as follows: *Reading is that language study which deals with discourse as to its interpretation and the oral expression of its thought and feeling in the language of the author.*

It appears from this definition that there are two phases of reading—interpretation and oral expression. These two phases are usually called *silent reading* and *oral reading*, and they may be defined as

follows: *Silent reading is the process of getting the thought and feeling embodied in discourse. Oral reading is the process of communicating aloud in the language of the author the thought and feeling embodied in discourse.*

## CHAPTER IV.

### PROCEDURE IN TEACHING READING.

*Stages of Reading.*—For the purpose of studying its method it is convenient to divide reading work into two stages,—the first, in a very general way, consisting of about the first three years of the child's reading work; and the second, in a general way, consisting of the rest of the work the child does in reading in school. Various names have been given to these two stages. The first stage has been called the *preparatory stage*, the *primary stage*, the *first stage*, and the *word stage*. The preparatory stage is a very good term, because it is significant of the fact that it is the stage in which the learner is preparing to do real reading later on. The second stage has also been given various names. It has been called the *stage of reading proper*, the *advanced stage*, the *second stage*, and the *discourse stage*. The stage of reading proper is perhaps the most significant term for this.

*The Preparatory Stage.*—This stage is characterized by the two following points: (1) the written or printed word as an isolated thing is dealt with largely as to the idea for which it stands; (2) the little pieces of discourse dealt with are not important because of the value of the thought they express. That is to

say, in this stage the child will learn a vocabulary of written or printed words as to meaning in order that he may recognize them in their connection in discourse later; also, he will read little pieces of discourse most of which do not contain thought of permanent value. Of course, some pieces he studies will contain thought of permanent value, but these will be the exceptions rather than the rule in this stage of reading work.

*Illustration.*—In this stage of the work the following words would be good ones to teach the child: *table*, *on*, *see*, *I*, *it*, *black*, *big*, *the*, and *a*. These would be taught to the child so that he could recognize them at sight, and know both the idea for which they stand and their correct pronunciation. After this was done these words might be combined into the following piece of discourse and used as a reading lesson:

I see a big hat.
It is on the table.
The hat is black.
The hat on the table is black.
The big black hat is on the table.

In the first part of this work the child is dealing with words as wholes as to the ideas for which they stand and as to pronunciation. In the second part he is dealing with a piece of discourse whose thought is of little value.

*The Stage of Reading Proper.*—This stage is characterized by the following: (1) discourse as a

whole is dealt with predominantly, and the word as a whole is dealt with much less than in the first stage; (2) discourse which embodies thought valuable in itself is dealt with largely. There will perhaps be selections dealt with whose thought is not very valuable, but these will be the occasional and not the rule. And again, in the second stage emphasis will be upon the interpretation, while in the first stage oral expression will be emphasized.

*The Starting Point.*—The starting point in teaching beginning reading will be determined (1) in the light of what the child already knows when he comes to school which can be used to build upon; that is, upon the basis which the average child has when he comes to school; (2) in the light of what the first reading work is. That is to say, the child must be led to the unknown from the *nearest related* known.

*Basis.*—What does the average child at the age of six know that can be used as a basis to build upon in beginning to teach him reading? The answer to this question is, (1) he has a goodly stock of ideas of objects, attributes, and relations in the world about him; (2) he knows the oral expression, or oral symbol, or oral word, for these ideas. Another way of saying this is, that the child has quite a good vocabulary of oral words as representing their ideas. There has been considerable systematic study of children's vocabularies with a view of finding out how many words the average child knows and can correctly use

when he comes to school at the age of six. The following are some results of such study as reported by parents: "The vocabulary of Portia Bell, when two years old, December 1, 1899, consisted of 1,073 words." "The vocabulary of Lyle Hugart, Valparaiso, Ind., consisted, when she was 2 years 5 months old, of 973 words." The vocabulary of Helen Neet, when 4 years 8 months old, consisted of 1,468 words. From these cases it seems safe to make the inference that the average child when he comes to school at the age of six has at least, a vocabulary of 1,200 oral words. This, of course, does not mean the child could define this number of words if called upon to do so, but it means he uses this number of words correctly in conversation.

*The First Unknown.*—Having found out what the child knows upon which we can build in teaching the first reading work, the next question is, What is the first unknown we want to teach the child? The thing the child knows is a vocabulary of oral words, and the first thing unknown which he must know to read the least bit is *a vocabulary of printed or written words.* Accordingly the starting point in teaching reading is *to teach the child a vocabulary of written or printed words.*

*Methods of Beginning.*—Several methods are used or have been used, in teaching the child this vocabulary of written or printed words. All of the follow-

ing are in use to a greater or less extent in various parts of the United States:

1. The Alphabet Method.
2. The Synthetic Word Method.
3. The Analytic Word Method.
4. The Sentence Method.

For the help we will get from the study we can profitably devote some time to each of these.

*The Alphabet Method.*—This is no doubt the oldest and very poorest method of teaching beginning reading. The Greeks in ancient Athens used this method 2,500 years ago. According to this method the teacher proceeds to teach the children the alphabet by rote. The teacher points to a letter and pronounces its name and asks the child to pronounce it; then he points to another, pronounces it, and asks the child to pronounce it; then another, and another, and so on through the alphabet. This sort of thing is kept up from day to day until the child knows the names of the letters at sight, successively, promiscuously, or in an inverse order.

The next general movement is to teach the children to spell orally small words made up, of course, of the letters whose names the children know. This line of work may be begun before the children have learned the names of all the characters of the alphabet. Thus these two lines of work—(1) learning the names of the letters by rote; and (2) learning to spell orally—overlap.

After having learned to spell, and pronounce orally a number of words in the manner indicated above, the children are started to read small pieces of discourse made up of the words they have been learning to spell orally. When they come to new words, according to this method, the children are encouraged to spell them out.

It is evident that this method must be a very slow and difficult way for the children to learn to read. In fact, from a pedagogical view point, it has not one feature to recommend it. There are numerous things to be said against it, but nothing to be said for it. The following are the objections to it:

1. It is, for a long time, the most formal and driest sort of rote work.

2. It is almost wholly devoid of inherent interest to the children.

3. The children have no basis for the work.

4. It ignores the children's knowledge of words, which constitutes the real basis for beginning reading work.

5. It gives children a dislike for school work.

6. It encounters the difficulties which arise from the dissimilarity between the names of letters and their sounds when combined into words and syllables.

7. The practice of having children to spell out the new words leads to halting, hesitating habits of reading.

One would scarcely think that this method is used extensively at the present stage of educational progress in the United States, but it is still used in many places.

*The Synthetic Word Method.*—The term *synthetic* means a putting together. So from the significance of the term, the inference one would make is that something is put together to make up the word. And this is right, for words are built up of the sounds composing them, according to this method. Thus the oral word is built up, but since the child is well acquainted with the oral word, he readily associates it with the printed or written word.

This method with slight variations has been given all the following names: *Synthetic Word Method; Phonic Method; Phonetic Method:* and *Pollard Method.*

By this method the teacher proceeds to teach the child the sounds which the various letters of the alphabet symbolize. Since the vowels and some of the consonants symbolize more than one sound, the diacritical marks must be used with the letters. The names of the letters are not learned at first, but some fanciful name is given, and the child and the teacher "play" that it says so and so—the sound which the letter symbolizes. Thus ā is called an old man, and the teacher and children "play" that he says āē; ă is called the little lamb, and the teacher and children "play" that it says ă, ă, ă; ä is called the little old

woman and they "play" that she says ah, ah, ah; b is called the baby and they "play" that it says the b sound; p is called a steamboat; f is called a cat; v is called a bug; d is called a dove; z is called a bumble bee; ḡ is called a frog; r is called a dog; th is called a goose; ch is called a locomotive, etc. All the symbols of the various sounds are thus given "play names," and the children learn the sound symbolized by each symbol in play.

After the sounds of the symbols have been well learned in this way, the teacher says to the children, "Now we have just been playing that this (ā) is an old man. Would you like to know its real name?" The children will want very much to know, and will say so. The reason that they will want to know is this: naturally, as soon as the child knows the meaning of anything, he wants to know its name. The children in this case know the sounds the letters symbolize, which is the meaning of letters and the only meaning, and so naturally want to know their right names. The teacher then tells them the right name of the symbol, and thereafter calls it by the right name when speaking of it with the children. The children are also encouraged to call it by the right name when they speak of it. Thus they learn the name without any special effort; that is, *incidentally*.

The method of learning the names of the other letters of the alphabet is as nearly like that in learning the name of ā as possible.

Having now taught the sounds the various characters symbolize, and the names of the various characters of the alphabet, the teacher next leads the children to recognize written or printed words at sight *as the symbol of oral words.* The procedure is as follows: The teacher writes or prints the sentence, the hăt ĭs ŏn the bŏx, or any other simple sentence on the board, and asks the children to tell what the words are. Each word is worked out first, then the whole "story" is asked for. If any trouble arises in working out the words, the teacher calls for the sound of each symbol separately, but it is better to get the whole oral word, if possible. For instance, if the child could not pronounce the at sight, the teacher would ask for the sound of th, then the sound of e, then for the whole word. This makes it very easy for the child, since he well knows what sounds the various symbols represent.

After reading this one sentence, the teacher puts a second on the board using several of the old words but some new ones. Then another sentence, and another; then simple pieces of discourse containing mainly old words, but always introducing some new ones.

Then pieces of discourse gradually increasing in complexity are used, and soon the book is put into the hands of the pupils, and they move rapidly forward.

*Merits and Demerits.*—The Synthetic Word Method

of teaching beginning reading has both its merits and its demerits. The following may be considered as points in its favor:

1. It takes advantage of the play instinct in children, and is thus very interesting for them.

2. It takes advantage of the basis consisting of a vocabulary of oral words which the children have.

3. It tends to make the children self-helpful in working out the pronunciation of new words.

4. It tends to habits of clear, distinct enunciation, and correct pronunciation.

5. It makes the teaching of diacritical marks easy.

The following may be noticed as objections to it:

1. It is unnatural for the child to build up words; he naturally learns them as wholes first.

2. It leads the child to make the association between the oral word and the printed or written word, while he should make the association between the printed or written word and the idea which it symbolizes.

3. He starts to read discourse in which the diacritical marks are used, which is not the kind he will be called upon to read throughout his life.

4. Trouble is experienced in changing from one to the other.

There are some other objections to this method, but these are the chief ones.

It should be said that many good teachers use

this method in teaching beginning reading, and have remarkable success. Others succeed better by some other method.

A few years since the Synthetic Word Method was very popular in many sections of the country, but recently it has been losing in popularity and favor.

*The Sentence Method.*—By this method the child is taught whole sentences as symbolizing thoughts. Thus the child is in some way stimulated to think and to indicate to the teacher what thought he has; the teacher then puts on the board the sentence which symbolizes the thought and endeavors to lead the child to associate the thought and this symbol. The following will indicate the procedure:

The teacher asks the child with what he plays, and he says "I play with a ball." The teacher then says "I shall put on the board what makes me think what you said," and writes or prints on the board "I play with a ball." The teacher then asks the child what the sentence says. A second question is then asked; it may be, "What is the color of your ball?" The child answers "My ball is red." The teacher again says "I shall put on the board what makes me think what you said," and writes or prints "My ball is red." Then, as before, the teacher asks the child what the sentence says. If the child should not start readily, the teacher continues with sentences containing the same or very nearly the same words till

he thus becomes familiar with a few sentences, thereafter varying the sentences.

This method of teaching beginning reading is put tolerably plainly by saying the teacher engages the child in some interesting conversation, and uses his sentences as material for the reading work.

After a time the sentences with which the child is familiar are broken up into their parts—the words.

There are some advantages claimed for the sentence method as well as some objections urged against it.

The following are claimed as advantages:

1. It gives a tendency to the mind to grasp sentences as wholes in reading.

2. From this grows the ability to interpret readily, and to communicate easily in reading.

This may all be said by saying it tends to make light readers. Some persons in reading interpret the selection word by word and are, for that reason, called heavy readers. Others grasp whole sentences, and some even whole paragraphs, in one act of the mind in interpreting discourse and are, for this reason, called light readers. That is to say, some use many times as much energy in reading as others use. It is claimed, and it seems with some degree of validity, that the sentence method tends to make light readers.

The following are some objections to the sentence method:

1. It leads the child to make an indirect association between the symbol, *the sentence*, and the thought, while the association should be direct. This appears from the fact that the teacher gets the child to use the oral sentence, and tells him she is going to place on the board what he says, or something to that effect, the child making the association between the oral sentence and the written or printed sentence instead of between the written or printed sentence and the thought.

2. The sentence which the child learns as a whole is not what he will find used as he learned it very often in his life. But if he should learn a word as a whole, he would very frequently find it in after life just as he learned it.

3. The sentence method furnishes poor opportunities for making the association between the symbol and the idea or thought symbolized strong. But if this association is not made strong the child can not remember what the words and sentences are; that is, he will not recognize them at sight, which is the thing aimed at.

*The Analytic Word Method.*—The word method of teaching primary reading is usually understood to mean what some have called the "Analytic Word Method," and what will be discussed in detail here under the title of Analytic Word Method. According to this method written or printed words are taught as wholes as symbolizing their ideas, or as to their

meaning. After a number of words have been taught as wholes these same written or printed words are analyzed into the parts which symbolize the parts of the oral word—the sounds.

*Definite Procedure.*—The first thing to be done in teaching by the Analytic Word Method is to teach the children a vocabulary of written or printed words *as standing for their ideas.* Various teachers teach with good success a vocabulary of from 40 to 75 words in this first work. The following is the way it is done:

Let the lesson be to teach the children the printed or written word, *nest*, as a symbol of the idea, *nest.* The teacher presents an actual nest to the children and tells them to hold up their hands, if they know what it is; then a second one is presented, and a third, and thus several. The teacher then puts the word on the board calling the attention of the children to it by saying "I am going to make a word on the blackboard which makes me think what I have in my hand." The teacher holds a nest in her hand in the meantime. The children thus make the association between the word and the idea it symbolizes. The steps in the above process are as follows:

1. The advance of the learner's mind in rethinking the old idea.

2. The advance of the learner's mind in adjusting itself to the symbol—the word.

3. The advance of the learner's mind in making the association between the idea and the symbol.

Each of these steps should be studied briefly. In the first the learner rethinks the old idea; that is, thinks it again. It is old to him, because he learned what a nest is sometime in his life before he came to school. The object of having the actual nest before him is to get him to rethink the old idea. Several nests are presented in order that the idea may be general, that is, apply to any nest, instead of just one particular nest, which might result from presenting but one nest.

In the second step the child looks at the symbol, gives his attention to it, and this is what is meant by adjusting his mind to it. In this, as in the first step, the word should be in several places on the board, and it should be found in other places; as on a chart, in the book, on cards, etc., in order that the symbol may be understood to be general. It is a good plan to have it written in various sizes in different colored chalk.

While all three of these steps are important, the last is the one upon which depends the value of all three. It is very desirable that the learner recognize the word at sight ever after the lesson. He will do this surely if the *association* is made strong enough. Otherwise he is likely to forget the word before the next lesson. So special pains must be taken to have the association strongly made. It may be done as follows:

1. Have the children point out with a pointer the

words on the board which say what the teacher has, the teacher handling the object. 2. Have the child bring the object when the teacher points to the symbol. 3. The child finds the word on cards, on charts, and in books.

It is to be noted in this work that the oral word is not used until the very close of the lesson, then some child is called upon to tell what the word is; that is, pronounce the oral word. The purpose of keeping the oral word in the background is, that the child may get into the habit of making the association directly between the written or printed symbol and the idea, and not indirectly between the written or printed symbol and the oral word, and from the oral word to the idea. Thus if when the child sees the word, *nest*, the idea comes first into the mind, it is because those things have been directly associated. But if, when he sees the word, *nest*, the oral word comes first into mind and then the idea, it is because the association between the written or printed symbol and the idea has been made indirectly. Two evils are said to grow out of making the association between the written or printed word and the oral word, and then between the oral word and the idea. They are as follows:

1. It tends to make heavy, slow, hesitating readers. It wastes energy.

2. It tends to give children the habit of using the vocal organs—working the lips, etc.—in silent

reading. Both of these habits are undesirable, the second being very annoying in school work.

*Adjectives and Action Words.*—The teaching of the word, *nest*, is a fair example of how all nouns are to be taught in this first work in reading. Adjectives and action words are not quite so easily taught, yet they are to be taught in substantially the same way. That is to say, the following three steps are taken: 1. The child is led to rethink the old idea. 2. He is led to adjust his mind to the symbol—the written or printed word. 3. He is induced to make the association strong between the idea and its symbol.

*The, A, An, Is, Can, On, In, etc.*—Such words as these are the ones which are the most difficult to teach in this first work in reading. The point of difficulty is in getting the learner to rethink the old idea. The following will indicate what is probably the best way to proceed with these words. Assume that the child knows the words, *hat*, and *black*, they having been taught to him before as indicated above. The teacher asks the child to tell her the color of the hat, and the child responds "*The hat is black.*" The teacher says "I shall place on the board the words which make me think what you said," and writes the sentence on the board. Some child is then asked to point out *hat* and *black*. The children are then asked to tell the new words. In most cases they will get the new words at once. If they do not do so readily, the teacher asks some child to tell the story again

while the others watch. Then some child is asked to tell what the first word, "*The*," says, then the next, and the next, and the next. This is kept up until the children have well in mind *the* and *is*. Then this sentence, The black hat is on the box, may be obtained from the children by placing the black hat there, and by placing some differently colored hat on a chair. The teacher places the sentence on the board and thus teaches the word, *on*, in the same general way as *the* and *is* were taught.

It will be noticed that this way of teaching is a combination of the word method and the sentence method.

*Fixing the Vocabulary in Mind.*—One of the most important points in teaching the child a vocabulary of written and printed words is fixing each word well in the learner's mind as he proceeds. Unless this is done the rest of the work is pretty much of a failure. There are two good ways to do this, as follows: 1. A list of the words should be kept in some convenient place on the board and reviewed from day to day. In this review the teacher may ask for a word and have some child point it out with a pointer, or the teacher may point to the word and ask some one to pronounce it. The former way is better. 2. The second way to fix the vocabulary in the child's mind is to combine the words he learns into small pieces of discourse, and give him drill in reading them.

Both these ways are based upon the principle,

*two or more things held together in consciousness the most often, other things equal, are the most strongly associated.*

*Print and Script.*—The question, Shall we begin with print or script? always comes up for consideration in method in reading. Perhaps the most satisfactory answer to this question is, that it makes little or no difference which is taught first. Many good and successful teachers prefer to begin with the script, but the same may be said with respect to the print. There are points of advantage in either way. The following seem to favor beginning with print:

1. The most of the learner's reading in life will be reading of print, and so this is the most important for him to learn.

2. If the learner first learns script he must soon change from it to print, which will of necessity be attended with some waste of energy.

Beginning with script seems to have the following in its favor:

1. It makes busy work more easy to conduct.

2. It tends to make children equally good readers of script and print. And this is true of very few persons.

Personally I prefer to begin with print for the first dozen or so lessons, then introduce the script and carry the two along side by side.

*Reading of Simple Pieces of Discourse.*—As soon as enough written or printed words have been well learned, small pieces of discourse should be formed

from them. These pieces are used for reading lessons for the children. And a little later the learner begins reading from the chart or first reader. The interpretation of these pieces of discourse is easy, and the thought embodied is usually of no permanent value, but the oral expression is very important. The child here begins to form his habits of oral expression, and whether he ever becomes a good reader or not depends largely upon these habits. However much trouble it may be, the learner must not be permitted to form habits of halting, hesitating, monotonous oral expression. This is a critical period in the teaching of primary reading.

*Analysis Work.*—It will be remembered that we are studying what is called the *Analytic Word Method* of teaching primary reading. But up to the present no analytic work has been studied. This is not, however, because no analytic work should be done in the actual work in reading up to this place, but because in our study we must take the points consecutively, and we have just now reached the topic, *Analytic Work.*

This analysis, which is to be carried along with much emphasis through the entire preparatory stage of reading, consists in separating the oral words corresponding to the written and printed words which the child has been studying, into their parts, the sounds, and the association of these sounds with their symbols; that is, with the corresponding parts of the written and printed word.

The following will show the nature of this work: The child has learned the printed and written word, *box*, as a symbol for an idea, in the way already shown. The teacher writes the word on the board and has some child to pronounce it, thus getting the oral word before the class. The children are then led to see the first sound in the oral word and to make it; then the second, and the third; next, they are led to see that *b* symbolizes the first sound; *o*, the second, and *x*, the third. The steps the child's mind takes with these words are as follows:

1. The advance of the learner's mind in rethinking the oral word.

2. The advance of the learner's mind in analyzing the oral word into its sounds.

3. The advance of the learner's mind in analyzing the written word into the parts corresponding to the sounds.

4. The advance of the mind in making the association between the sounds and their symbols.

These steps are very general. A close analysis would break up each one into several smaller steps. But these are the general steps in the analysis of any word.

*First Step.*—The way to lead the children to take the first step is to write the word on the board, and ask the class how many know it, then call on some one to pronounce it. The test of his rethinking is his pronouncing it.

*Second Step.*—The analysis of the oral word into its sounds is a step of some difficulty with the first few words, but offers little trouble thereafter. Perhaps the best way to proceed at first is for the *teacher* to analyze the oral word into its sounds and have the children watch and give the analysis from imitation. This will be necessary with only a few words, for the children will soon gain much ability in this work. Soon they will be able to give original analyses.

*Third Step and Fourth.*—The third and fourth steps may best be taken together. Thus the child is led to see that certain parts of the symbol symbolize the different sounds in the oral word. He infers that *b* in the word *box* symbolizes the first sound in the oral word; *o*, the second, and *x*, the third. The teacher tells him this is right and thus gives him a start. Practice soon gives him considerable skill in this work.

*Time of Doing the Analytic Work.*—This analytic work may well be begun almost from the first; that is, as soon as the child has learned a dozen or so words as symbols of their ideas; and it should be carried on through the entire first stage of reading with considerable emphasis, at the least. It will probably be found necessary to do some of it at various places through the second stage of reading.

*Purpose of Analysis.*—This work is an extremely important kind of work in teaching reading, and a kind of work that is not generally well enough done.

It is important because it has the following purposes:

1. It makes the child self-helpful in the pronunciation of new words.

2. It enables him, to a large extent, to work out the new words as to pronunciation as he comes to them in reading.

3. It helps the child in forming the habit of distinct enunciation, and correct pronunciation in oral reading and in speaking.

4. It tends to enable the child to acquire these habits from the relation of the symbols of the sounds, and not by use of the diacritical marks or the dictionary.

*Working Out New Words as to Pronunciation.*—In taking up the new lessons for study in the first stage of reading and the first year or two of the second stage words new as to pronunciation will be met with by the children, and the best way to deal with these words has been a problem to many teachers. It is safe to lay down the law that in dealing with these words *the work must be of such a character as to lead the students to do the work for themselves and to make them self-helpful* in such work. Work of the following character will certainly do this: In general, it may be said that the learner is to be led to work out the new words by seeing parts of old ones whose pronunciation he knows, in the new ones. For instance, *ago*, *things*, *called*, *loved*, and *blue-bell* are the new words in a lesson. The children have already had the words,

*a, go, think, running, call, played, love, sad, blue* and *bell.* So if the children can be led to put together *a* and *go; th, ing* and *s: call* and *ed: love* and *d: blue* and *bell* they will have the pronunciation of the new words. The child will not do this without lessons leading him into the habit of doing so. In pursuit of this idea the teacher may make some such assignment as this to the children: "Study your lesson through carefully and make a list of all the new words and all the old ones you can not pronounce. See how many you can work out the pronunciation of by hunting for old words or parts of old words in them. Make a list of words which you think will help in pronouncing the words you can not pronounce." It is evident that this kind of assignment tends to lead the children into the habit of working out the pronunciation of words for themselves—the thing desired. If the children do not have the pronunciation of the words worked out, and they would not ordinarily have all worked out, the teacher places one of the words on the board, and asks if any one can see anything old in it. If the children do not, the teacher writes some old word on the board which will give them a start and so on until the word is worked out; then the next word, and the next till all the words have been pronounced by the children.

The new words the children meet will be of these two kinds: (1) those that can be pronounced by analogy, such as *things, called,* etc.; (2) those that

can not be taught by analogy, such as *through*, *women*, etc. This second class may be taught in the same way as *the*, *is*, *can*, *a*, and *an* were taught.

*Diacritical Marks.*—These are characters which indicate the sounds the various letters symbolize when used in words. They are the macron (–), the breve (⏑), the caret ( ^ ), the dieresis ( ¨ ), the semi-dieresis ( · ), the tilde ( ~ ), the cedilla (¸), and the suspended bar ( ‿ ).

The diacritical marks and their uses should be taught to children in their reading work. And the purpose of this work is *to enable* the child to use the dictionary intelligently and with facility. And this is the whole purpose of teaching diacritical marks.

If the analysis of words has been carried along through the first stage of reading, the teaching of diacritical marks becomes an easy task. This work should begin as early as the second year, and should be continued until the work is *well* learned.

*Second Stage.*—In the first stage of reading the beginning of correct habits of oral expression was a very important part of the work, and the pieces of discourse dealt with were in the main not important because of the value of the thought symbolized. In the second phase of reading the emphasis is placed upon the interpretation of the discourse, that is, getting the thought and feeling the discourse symbolizes; and the discourse dealt with in the main is

important because of the value of the thought and feeling it symbolizes.

*Didactic and Symbolic Discourse.*—In this phase of reading both didactic and symbolic discourse will be dealt with, and thus they come up for study here.

Didactic discourse is also called scientific discourse, perhaps because it is the kind employed in all scientific treatises. It directly sets forth truth. For instance, if one should say that man is irritable, ferocious, and bloodthirsty, the characteristics of the man are set forth directly and the sentence is an example of didactic, or scientific, discourse. But if one should say that man is a tiger, the characteristics of the man are set forth indirectly, and the sentence is an example of symbolic discourse. The tiger is the symbol, or type.

Symbolic discourse is also called *literary* discourse, perhaps because what is known as literature is largely symbolic discourse. It sets forth truth indirectly by means of a symbol, or type. The following will illustrate the two kinds: The young of dragon-flies are found in ponds and streams about which the adults fly, and are most abundant among the stems of submerged plants; they are also found crawling over the bottoms of ponds and streams where there are no plants growing. They vary greatly in form, some being slender while others are very broad. They live and grow this way till a day comes when an inner impulse causes them to climb

some weed stem; their backs split open and the adult dragon-flies come out, dry their wings and fly away. The above is purely didactic. Why?

The following is literary or symbolic:

> "To-day I saw the dragon-fly
> Come from the wells where he did lie.
> An inner impulse rent the veil
> Of his old husk; from head to tail
> Came out clear plates of sapphire mail.
> He dried his wings: like gauze they grew:
> Through crofts and pastures wet with dew
> A living flash of light he flew."

"Excelsior," "Evangeline," "The Chambered Nautilus," "To a Waterfowl," "The Great Stone Face," and "Sour Grapes" are other examples of symbolic discourse.

*Steps in Symbolic Discourse.*—In mastering a piece of symbolic discourse as a reading lesson evidently the first thing the learner meets with is the language, whose mastery is the first step. The language reveals the symbol, the mastery of which is the second step. The symbol reveals the leading thought, or theme, whose mastery is the third step. A fourth step is the mastery of the adaptation of the symbol to the leading thought. And the last step is the oral reading of the selection. Thus every reading lesson which deals with symbolic discourse is like every other one in that the mind takes the following steps in mastering it:

1. The mastery of the language.
2. The mastery of the symbol, or picture.
3. The mastery of the leading thought.
4. The mastery of the adaptation of the symbol to the leading thought.
5. The adequate oral expression of the thought and feeling in the author's words.

The language is to be mastered in two ways: first, as to the meaning of the separate words in their connection; and, secondly, as to the pronunciation of the different words.

By the mastery of the symbol, or picture, is meant that all parts of the story as presented by the language are to be learned and vividly held in mind. There are several terms here used as synonyms to mean the same as the symbol. The terms symbol, picture, type, embodiment, and conception are all more or less in use. This second step is an important one in teaching reading. Many teachers do not lead their children by their assignments to *master* the symbol and thus fail to some extent in teaching reading.

Every selection which is organized and is worth spending one's time upon as a reading lesson has some leading thought around which all the subordinate thoughts cluster. This leading thought is the most important thing in the selection. It is the message the selection bears to humanity, and the understanding of it is the key to the correct interpretation

of the selection. Therefore, in teaching reading, the mastery of the leading thought, or theme, is a very important step.

By the adaptation of the symbol to the leading thought is meant that the various parts of the picture are chosen because they are good to suggest the theme and make it strong. That is to say, the parts of the picture and the picture as a whole are adapted to set forth the thought. For instance, if one says a man is a donkey, he means that the donkey, the symbol, is well adapted to set forth the stubbornness of the man, the leading thought. The mastery of the adaptation of the symbol to the theme is of prime importance in teaching reading. In leading the learner to master this step opportunities for rare skill and tact in teaching present themselves.

After the four steps discussed above have been taken the learner should have well in mind the thought and feeling of the selection, and should thus be in a good condition to read well the selection orally. And this remains to be done as the last step.

*Steps in Didactic Discourse.*—The steps in mastering a piece of didactic discourse are not the same as in mastering a piece of symbolic discourse. Didactic discourse has no symbol, or embodiment; and since this is true, steps two and four in the symbolic discourse are absent in the mastery of didactic discourse. Then the mind in mastering selections of didactic discourse takes the following steps:

1. The mastery of the language.

2. The mastery of the leading thought, or theme.

3. The adequate oral communication of the thought and feeling in the author's words.

*Summary.*—The following will summarize the steps in teaching reading, granting that the *analytic word method* is the method employed:

I. First Stage.

$1^1$. The mastery of a vocabulary of words as symbolizing their ideas.

$1^2$. Steps with each word.

$1^3$. The advance of the learner's mind in rethinking the old idea.

$2^3$. The advance of the learner's mind in adjusting it to the written or printed symbol.

$3^3$. The advance of the learner's mind in associating the symbol and the idea.

$2^1$. The interpretation and oral reading of small pieces of discourse made up from the words which the child has in his vocabulary.

$3^1$. A line of analysis work.

$1^2$. Steps with each word.

$1^3$. The advance of the learner's mind in rethinking the oral word.

$2^3$. The advance of the learner's mind in analyzing the oral word into its sounds.

$3^3$. The advance of the learner's mind in analyzing the written word into the symbols of the sounds.

$4^3$. The advance of the learner's mind in associating the sounds with their symbols.

$4^1$. A line of teaching the diacritical marks.

II. Second Stage.

$1^1$. The mastery of symbolic discourse.

$1^2$. Steps.

$1^3$. The mastery of the language.

$2^3$. The mastery of the symbol, or picture.

$3^3$. The mastery of the central thought, or theme.

$4^3$. The mastery of the adaptation of the symbol to the leading thought.

$5^3$. The adequate oral communication of the thought and feeling the discourse embodies in the author's own words.

$2^1$. The mastery of didactic discourse.

$1^2$. Steps.

$1^3$. The mastery of the language.

$2^3$. The mastery of the leading thought.

$3^3$. The adequate oral communication.

## CHAPTER V.

### CONCRETE ILLUSTRATIONS.

*Advantages of.*—A good teacher should always be able to make clear his points with good concrete illustrations, and one who does not do so will find his teaching lacking much in effectiveness. Concrete illustrations make the thoughts stand out in clear relief and bring the desired truths before the mind so vividly that they are easily retained and reproduced. Therefore, for the help that comes from the study we will consider in this chapter some concrete illustrations.

EXCELSIOR.

The shades of night were falling fast,
As through an Alpine village passed
A youth, who bore, mid snow and ice,
A banner with the strange device,
Excelsior!

His brow was sad; his eye beneath
Flashed like a falchion from the sheath,
And like a silver clarion rung
The accents of that unknown tongue,
Excelsior!

In happy homes he saw the light
Of household fires gleam warm and bright;
Above, the spectral glaciers shone,

And from his lips escaped a groan,
Excelsior!

"Try not the Pass!" the old man said;
"Dark lowers the tempest overhead,
The roaring torrent is deep and wide!"
And loud that clarion voice replied,
Excelsior!

"Oh stay," the maiden said, "and rest
Thy weary head upon this breast!"
A tear stood in his bright blue eye,
But still he answered with a sigh,
Excelsior!

"Beware the pine-tree's withered branch!
Beware the awful avalanche!"
This was the peasant's last Good-night,
A voice replied, far up the height,
Excelsior!

At break of day, as heavenward
The pious monks of Saint Bernard
Uttered the oft-repeated prayer,
A voice cried through the startled air,
Excelsior!

A traveler, by the faithful hound,
Half-buried in the snow was found,
Still grasping in his hand of ice
That banner with the strange device,
Excelsior!

There in the twilight cold and gray,
Lifeless, but beautiful he lay,
And from the sky, serene and far,
A voice fell, like a falling star,
Excelsior!

The mind, if left to pursue its own course in mastering this selection of symbolic discourse as a reading lesson, (1) will read the selection through to get a general idea of it as a whole; (2) will study it through in detail taking the five steps indicated above in the mastery of a selection of symbolic discourse.

In the mastery of the language the meaning of the words, *Alpine*, *Excelsior*, *falchion*, *clarion*, *spectral*, *glaciers*, *lowers*, *avalanche*, *monks*, *Saint Bernard*, etc., will be mastered; also, the words *passed*, *Excelsior*, *Alpine*, *beneath*, *falchion*, *glaciers*, *pass*, *lowers*, *blue*, etc., will be mastered as to their pronunciation.

In the mastery of the picture, or symbol, the youth with his various attributes, the mountains, the Alpine village, the banner, the happy homes, the glaciers, the old man, the tempest, the roaring torrent, the maiden, the pine-tree's withered branch, the avalanche, the peasant, the monks of Saint Bernard, etc., will be got well in mind in their proper relation.

In the mastery of the theme the real meaning of this whole picture will be worked out. The picture itself has meaning, but the deeper meaning beyond itself and to which it points is the theme. Longfellow is not simply telling about a rash young man who lost his life in climbing the Alps mountains. The selection bears a message to humanity and the picture symbolizes this message. And getting this well in mind is what is meant by mastering the theme.

In the mastery of the adaptation of the picture to the theme the reason for choosing a youth, for starting him at dusk, for having him to climb a mountain, and for having him to lose his life will be shown. Also, the significance of the banner, the village, the maiden, the old man, the pass, the glacier, the torrent, the awful avalanche, the peasant, the monks, the falling voice, etc., will be shown as contributing to the leading thought.

The oral reading of the selection comes as the last step, and should not offer much difficulty after the other four steps have been well done.

The following is an assignment which has for its purpose to lead the learner in working through Excelsior as a reading lesson:

1. Read the selection through very carefully and try to see what it means.

2. Master the meaning and pronunciation of any unfamiliar words in the selection.

3. Get in mind well the details of the picture presented in this poem.

4. What is the leading thought in the selection? Give good reasons for your opinions.

5. Why is a youth chosen?

6. Enumerate the characteristics of the youth and tell why each one is given.

7. What is the significance of the happy homes, and of the maiden?

8. What is the significance of the lowering tem-

pest, roaring torrents, spectral glaciers, pine-tree's withered branch, and the awful avalanche?

9. Why must the youth lose his life?

10. What is the meaning of the voice that fell, like a falling star?

## ERASTUS WREN'S VIRTUE.

Erastus Wren was virtuous, in spirit and in letter,
Was very virtuous and good, and daily growing better;
And so immaculate was he, his neighbors, men and maids,
They daily looked to see the wings sprout from his shoulder blades.

He wouldn't eat rice: he wouldn't drink tea no more than he'd drink rum,
For they were grown by heathen hands in darkest heathendom;
He'd have no fellowship, he said, with men who thus behaved,
Nor boom the industries of men so totally depraved.

So he lived devoid of coffee and of cocoanuts and spice,
And when his folks had lemon pie he never touched a slice;
And he'd never taste of pudding; nay, unless, beyond a doubt,
The cook deposed and guaranteed all nutmeg was left out.

He wouldn't wear cotton shirts at all, because he was afraid
The girls who work in cotton mills are sometimes underpaid;
And once he thought he'd wear no wool, it gave him such a shock
When he was told that one black sheep was found in every flock.

And he never read the papers, and he never would begin,
He said they reeked with wickedness, iniquity and sin;
He wouldn't consult the dictionary, nor turn a leaf, not he,
Because he said it held bad words no good man ought to see.

There was no food for him to eat, no clothes for him to wear,
No mental sustenance at all to suit him anywhere;
And so he died,—the thing to do to round out his perfection,—
And not a living man arose to make the least objection.

*Assignment.*—The following assignment should lead the learner in mastering the above selection as a reading lesson:

1. Read the poem through carefully as a whole.
2. Master any unfamiliar words found in it both as to meaning and as to pronunciation.
3. Get carefully in mind all the characteristics of Erastus Wren.
4. What in your judgment is the message the poem has for humanity? Give reasons for your opinion.
5. Try to show the adaptation of any part of the embodiment to the theme.
6. Read the lesson orally so as to bring out the thought and feeling as you understand it.

## THE GOLDEN TOUCH.

King Midas loved money very much, but not quite as well as he loved his little child, Mary. He thought yellow gold was the most beautiful thing he had ever seen, and he wanted to get as much of it as he could. Yet King Midas was a very rich man. He had boxes of this yellow money, and every day he looked at it for a long time.

Once when he was looking at his gold, and thinking how beautiful it was, he saw a man standing by his side. "You are very rich, King Midas," said the man. "Well, yes; I have some money," said the King. "Do you care for more?" said the man. "Oh, yes," said King Midas "I have only a very little, after all. "Well," said the man, "I shall be glad to help you. You may make any wish you like, and I will grant it to you." King Midas thought a long time about this wish. What could he wish that would give him all the gold he wanted? At last he had a happy thought. He would wish that everything he should touch might turn to gold! Then he told the man his wish. How he laughed to hear that this rich old king still wanted so much more money! "At sunrise tomorrow morning," said the man, "your wish shall be granted. Then everything you touch shall turn to gold. I will give you the Golden Touch."

The old king slept very little that night. As soon as the sun rose in the morning, he put his hand on his bed. His wish had been granted. There was his

bed turning into yellow gold. When he put on his clothes, they, too, were gold. He took up a book on the table, and its cover became yellow, and he saw it had golden leaves. He went around the room and touched everything. Each turned to gold, and he thought his room was very beautiful.

The King was very happy when he called little Mary to come and sit down and eat. As soon as the King touched his cup, it was gold. When he took a bite of fish, it, too, turned into gold, and he could not eat it. Then he tried to eat his egg and bread, but he could not. They were hard, yellow gold. Poor King Midas was very hungry! Everything was so beautiful, he was so rich, and yet he could not eat a bite! "What is the matter, father? Why don't you eat?" said little Mary. And she came and stood by his side. The king kissed her and said, "My dear little girl, go and eat your bread and milk." But what was the matter? The sweet, rosy face was now yellow, and the soft, pretty curls were hard. The little girl he had loved so well, King Midas had turned into gold. "What have I done?" cried the poor king. "My dear little child! My Mary!"

Just then he saw the same man standing at his side who had given him the Golden Touch. "Well, King Midas, how do you like the Golden Touch?" said the man. "I am so unhappy!" said the King, still looking at his little daughter. "Unhappy!" said the man. "Did I not do as I said I would? Do you wish

more gold still?" "Oh, no, no!" said Midas. "I have lost what I loved more than gold,—my little child, Mary! Give her back to me alive and well!" "Ah," said the man, which is the better, the gift of the Golden Touch or a cup of cold water?" "The cup of water," said Midas. "And which is the better, the Golden Touch or your own little Mary as she used to be?" "My child, my dear child!" cried the king. "I would not give one of her little soft curls for all the gold you might give me!" "Tell me, King Midas, said the man, "shall I take away the Golden Touch?" "Oh, yes, indeed!" said the king. "You are a better man than you were yesterday, King Midas, and I will take away the gift of the Golden Touch, if you wish. Go to the brook just back of the garden and wash, and bring a cup of the same water back with you."

The King lost no time in going to the brook. He jumped into the water, saying, "I do hope this will wash away the Golden Touch. Why did I ever want it, I should like to know." He filled the cup, and walked back to the house very fast. The first thing he did was to put water on his little Mary. Then the old rosy color came back, she laughed, and was his own loving child again. Then he went about the house and made everything as it was before he had turned it into gold. The old King never wished again for the Golden Touch.

The above lesson from the Indiana Second Reader is a piece of symbolic discourse, though it is not poetry. The steps in teaching it are the same in general as in teaching any other piece of symbolic discourse, namely:

1. The advance of the learner's mind in getting a general idea of the lesson as a whole.

2. The advance of the learner's mind in mastering the language.

3. The advance of the learner's mind in mastering the details of the picture or symbol.

4. The advance of the learner's mind in seeing and feeling the central thought.

5. The advance of the learner's mind in mastering the adaptation of the picture to the central thought.

6. The adequate oral communication of the thought and feeling.

With children of the second or third grade these steps would have to be worked out slowly, many questions being given by the teacher in assignments on each point. Let us assume that we have a second grade class, and study the following assignment:

1. Read the whole lesson through and tell me what you learned about it.

2. Make a list of all new words and any old ones whose meaning or pronunciation you do not know. Make a list of old words which you think will help you in working out the pronunciation of those you do not know.

3. How many persons are spoken of? What are their names? Tell all that is said about each one.

4. Do you believe this story? Why? Does it tell us anything true? What?

5. Why does this story have a king in it? Why gold? Why a man who could give the king the Golden Touch? Why a little girl?

6. Read it orally so as to bring out the meaning as you understand it.

## ORCHARD LIFE.

"An orchard is an excellent place for Nature Study. Here live many kinds of tiny creatures, each kind with its own peculiar mode of life. Some have comparatively simple life histories, merely eating and growing and finally laying eggs for another generation; but others undergo wonderful transformations, and still others exhibit an instinct that seems much like reason. And even those that appear to live the most humdrum existence are well worthy of careful study, for their lives are never as simple as they seem at first sight.

By a study of orchard life there may be learned also much that is of immediate practical importance; some of the most dreaded insect pests infest fruit trees. A thorough knowledge of the ways of these depredators enables us to plan successfully methods of destroying them, and thus to prevent their ravages."

In the mastery of the above lesson there are in general but three steps to be taken, for this lesson is purely didactic, or scientific.

It is no doubt true that reading books should be made up largely of literary, or symbolic discourse, and some have gone so far as to say that no other kind of discourse properly has a place in text-books on reading. But if it be true that the selections the child reads in school are to be of the kinds he will

read throughout his life, in order to fit him for all kinds of reading, a reading book must contain selections of both symbolic and didactic discourse.

There is also a place in teaching reading for what is called sight reading; that is, the reading of selections orally without having studied them beforehand. A goodly quantity of this kind of work should be done in the most successful teaching of reading.

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### ABOU BEN ADHEM.

Abou Ben Adhem—may his tribe increase!
Awoke one night from a deep dream of peace,
And saw within the moonlight in his room,
Making it rich and like a lily in bloom,
An angel writing in a book of gold.

Exceeding peace had made Ben Adhem bold;
And to the presence in the room he said,
"What writest thou?" The vision raised its head,
And, with a look made of all sweet accord,
Answered, "The names of those who love the Lord."

"And is mine one?" said Abou. "Nay, not so,"
Replied the angel. Abou spoke more low,
But cheerly still; and said, "I pray thee, then,
Write me as one that loves his fellow-men."

The angel wrote, and vanished. The next night
It came again, with a great wakening light,
And showed the names whom love of God had blessed;
And, lo! Ben Adhem's name led all the rest.

## CHAPTER VI.

### COMMON ERRORS IN TEACHING READING.

*Opportunities for.*—While reading has been in our school curriculum as long as any subject, and is as generally taught as any school subject, it is by no means an easy subject to teach well. The opportunities for errors are many, and because of this reading is generally taught much more poorly than it should be. The following may be mentioned as the most common of these errors:

1. The use of the alphabet method in teaching beginning reading.
2. A lack of sufficient phonetic work.
3. Too much emphasis on oral reading to the exclusion of interpretation.
4. A lack of sufficient thought interpretation.
5. Indefinite, general assignments.

Each of these will be studied briefly for the help that comes of the study.

*The Use of the Alphabet Method.*—It seems that at the present stage of educational progress it should be needless to call attention to the fact that to begin to teach reading by having the children to learn the names of the letters of the alphabet by rote is unpedagogical in the extreme, and so, exceedingly bad

teaching. There are, however, many teachers still teaching in this way, and many persons who believe in it, and also many who do not even know there is a more natural, more interesting and better way. The objections to the alphabet method have been stated before, and though they should be rethought, they will not be repeated here.

*Phonetic Work, or Sound Analysis.*—A lack of sufficient work in analyzing oral words into sounds, and associating these sounds with their symbols is the cause of several bad results in teaching reading. 1. It leaves children helpless in the pronunciation of new words. 2. It leaves with children bad habits of enunciation. 3. It makes their language in speaking and reading hard to understand. 4. It makes the teaching of diacritical marks much more difficult. It is certainly a great mistake not to carry on in the child's reading work a line of systematic phonic work.

*Oral Reading to the Exclusion of Interpretation.*—It is often customary in teaching reading to cover a rather large amount of discourse by having the children go through with it by pronouncing the words. This is called oral reading even when the learner does not get the thought himself, to say nothing of communicating it to some one else. This is a mistake because it gives the learner the wrong notion of the nature of reading as well as bad habits of reading. It is not the large quantity of discourse gone through which is the criterion of success in reading. It is the

power of ready, accurate interpretation plus the ability of adequate oral communication in the author's words which constitutes the criterion of success in teaching reading. And this may come from dealing with comparatively few pieces of discourse rightly taught, while it will certainly not come from dealing with a multitude of selections wrongly taught.

*Lack of Thought Interpretation.*—It will be recalled that the larger part of reading is what is called silent reading, or interpretation of the thought, and that the other part is the oral communication of this thought and its accompanying feeling. Now, no one can communicate thought which he does not have. Then interpretation, or thought getting, is fundamental to communication, or oral reading. As simple as this problem is, it certainly is the besetting sin in teaching reading that teachers ask their pupils to read orally—to communicate thought and feeling—when they have it not to communicate. A lack of thorough interpretation on the part of the student before an attempt is made to read orally is at the root of nearly all the errors that occur in oral reading, also. There are at any rate two very bad things that result because of not sufficient emphasis on interpretation in teaching reading.

1. The learner never becomes sufficiently skillful in getting the thought and feeling from discourse.

2. The extremely small number of students who really become good oral readers.

*Indefinite, General Assignments.* — An indefinite, general assignment is a very bad error on the part of the teacher in teaching any subject. But this truth applies with unusual force to teachers of reading as the work is usually done. Most of us can remember our own experience as students in reading, and it comes forcibly to our own minds that our lessons in reading were assigned by the teacher's saying "Take the next lesson." We can also remember that we did not know how to take it, when to take it, nor where to take it. And most of us were surely not much better off by the taking. With such an assignment as indicated above, the child will usually read *over* the lesson, which often does not take more than ten or fifteen minutes, and think he has it prepared for recitation. It is almost the universal experience of teachers of reading that they do not succeed in getting the students to study their reading lessons sufficiently. The main cause of this trouble lies with the teacher, and is to be found in the poor assignments given. If the teacher will see to it that every assignment in reading presents definite problems to be mastered, and conscientiously holds the children to the mastery of these problems, the difficulty in getting them to study their reading lessons sufficiently will largely disappear.

There is no other means in the hands of the teacher that may be used so effectively in making his teaching of reading a success as his assignments.

## CHAPTER VII.

### SUPPLEMENTARY READING.

*Nature of.*—In connection with the material in the text-book in reading other things should be placed in the hands of the children to read. Much of this kind of material should be used in what is called sight reading; that is, reading by the children without their having made previous preparation on the selection. Now, this kind of work is known as supplementary reading, and the selections are called material for supplementary reading.

*Need and Value of.*—There is much need for supplementary work in teaching reading. This need is for the following reasons, which may be put as purposes of supplementary reading:

1. To put more life and interest in the reading work, and thus make it easier for both the pupils and the teacher.

2. To make the students more quick in interpretation and oral expression.

3. To lead the pupils to love good literature, and thus into the habit of reading good literature.

*A Difficulty.*—All teachers recognize the value of supplementary reading and the desirability of having such work, yet many do not have the material and do not know where to get it.

To help teachers in obtaining such material a list of books and selections suitable for each grade is here arranged. These lists will be of books not only approved by our own judgment, but by the judgment of educators the country over. It is not expected that any teacher will be able to secure all these books, but some of them will doubtless be available for almost any earnest teacher.

FIRST YEAR.

1. Classic Stories for Little Ones, McMurry, Public School Publishing Co., Bloomington, Ill. - - .40
2. Twilight Stories, Foulke, Silver, Burdett and Co., Chicago. - - - - - - - - - - .35
3. Cyr's Primer, Ginn and Co., Chicago. - - - .30
4. The Werner Primer, The Werner School Book Co., Chicago. - - - - - - - - - ——
5. Our Little Book for Little Folk, American Book Co., Chicago. - - - - - - - - - .40
6. Cyr's First Reader, Ginn and Co., Chicago. - - .35
7. Fables and Rhymes for Beginners, Ginn and Co., Chicago. - - - - - - - - - - .30
8. Hodskin's Little People's Reader, Ginn and Co., Chicago. - - - - - - - - - - .30
9. Baldwin's First Reader, American Book Co., Chicago. - - - - - - - - - - .25
10. Stories for Kindergartens and Primary Schools, Wiltse, Ginn and Co., Chicago. - - - - .35

SECOND YEAR.

1. Robinson Crusoe for Boys and Girls, McMurry, Public School Publishing Co., Bloomington, Ill. - .25
2. Grimm's Fairy Tales, Wiltse, Ginn and Co., Chicago. .35

3. Stories Mother Nature Told Her Children, Ginn and Co., Chicago. - - - - - - - - - .50
4. Easy Steps for Little Feet, American Book Co., Chicago. - - - - - - - - - - .25
5. Verse and Prose for Beginners, Houghton, Mifflin and Co., Chicago. - - - - - - - - .25
6. First Year Nature Reader, Werner School Book Co., Chicago. - - - - - - - - - - ——
7. The Riverside Reader and Primer, Houghton, Mifflin and Co., Chicago, 205 pages. - - - - - .30
8. Johonnot's Book of Cats and Dogs, American Book Co., Chicago. - - - - - - - - - .17
9. The Hiawatha Primer, 147 pages, Houghton, Mifflin and Co., Chicago. - - - - - - - - .40
10. Cooke's Nature Myths, A. Flanagan, Chicago. - ——

THIRD YEAR.

1. Scudder's Fables and Folk Stories, 200 pages, Houghton, Mifflin and Co., Chicago. - - - - .40
2. Stories of Indian Children, Public School Publishing Co., Bloomington, Ill. - - - - - - .50
3. Cyr's Third Reader, Ginn and Co., Chicago. - .45
4. Stickney's Æsop's Fables, Ginn and Co., Chicago. .40
5. Short Stories of our Shy Neighbors, American Book Co., Chicago. - - - - - - - - - .50
6. Golden Book of Choice Reading, American Book Co., Chicago. - - - - - - - - - .30
7. Book of Tales, American Book Co., Chicago. - .50
8. Peabody's Old Greek Folk Stories, Houghton, Mifflin and Co., Chicago. - - - - - - - - .25
9. Myths of Old Greece, Pratt, Ginn and Co., Chicago. .60
10. Heart of Oak No. II. D. C. Heath and Co., Chicago. ——

FOURTH YEAR.

1. Hawthorne's Wonder Book, Houghton, Mifflin and Co., Chicago. - - - - - - - - - .40

2. Hawthorne's Tanglewood Tales, Houghton, Mifflin and Co., Chicago. - - - - - - - - .40
3. Kingsley's Water Babies, Ginn and Co., Chicago. .45
4. Francillon's Gods and Heroes, Ginn and Co., Chicago. - - - - - - - - - - - .50
5. Baldwin's Old Stories of the East, American Book Co., Chicago. - - - - - - - - - .45
6. Stories from Arabian Knights, Houghton, Mifflin and Co., Chicago. - - - - - - - - .40
7. Ruskin's King of the Golden River, etc., Houghton, Mifflin and Co., Chicago. - - - - - .25
8. Black Beauty, A. Flanagan, Chicago. - - ——
9. Pioneer History Stories, McMurry, Public School Publishing Co., Bloomington, Ill. - - - .50
10. Stories of Great Americans, American Book Co., Chicago. - - - - - - - - - - .40

FIFTH YEAR.

1. Anderson's Fairy Tales, Second Series, Ginn and Co., Chicago. - - - - - - - - - .45
2. Bunyan's Pilgrim's Progress, by Montgomery, Ginn and Co., Chicago. - - - - - - - - .35
3. Stories of Our Country, American Book Co., Chicago. - - - - - - - - - - - .40
4. Lays of Ancient Rome, Houghton, Mifflin and Co., Chicago. - - - - - - - - - - .25
5. The Voyage to Lilliput and Brobdingnag, Houghton, Mifflin and Co., Chicago. - - - - - - .40
6. Hawthorne's Wonder Book, Houghton, Mifflin and Co., Chicago. - - - - - - - - - .40
7. Polly Oliver's Problem, Houghton, Mifflin and Co., Chicago. - - - - - - - - - - .60
8. The Children's Life of Lincoln, McClurg and Co., Chicago. - - - - - - - - - - 1.25

9. First Book in American History, Eggleston, American Book Co., Chicago. - - - - - - - .60
10. Heroes of Asgard, MacMillan Co., Chicago. - .50

SIXTH YEAR.

1. Frye's Brooks and Brook Basins, Ginn and Co., Chicago. - - - - - - - - - - .70
2. Ten Boys on the Road from Long Ago to Now, Ginn and Co., Chicago. - - - - - - - - .60
3. Burrough's Birds and Bees, Houghton, Mifflin and Co., Chicago. - - - - - - - - - .60
4. Franklin's Autobiography, by Montgomery, Ginn and Co., Chicago. - - - - - - - - .50
5. Longfellow's Evangeline, Houghton, Mifflin and Co., Chicago. - - - - - - - - - - .25
6. Irving's Sketch Book.
7. Arabian Knights, by Hale, Ginn and Co., Chicago. .55
8. Hughes' Tom Brown at Rugby, Ginn and Co., Chicago. - - - - - - - - - - - .60
9. Lamb's Talks of Shakespeare, Houghton, Mifflin and Co., Chicago. - - - - - - - .50
10. Scudder's George Washington, Houghton, Mifflin and Co., Chicago. - - - - - - - .40

SEVENTH YEAR.

1. Scott's Lady of the Lake, Ginn and Co., Chicago. .45
2. Swift's Gulliver's Travels, Ginn and Co., Chicago. .40
3. Dana's Two Years Before the Mast, Houghton, Mifflin and Co., Chicago. - - - - - - - .60
4. Hawthorne's Tales of White Hills, Houghton, Mifflin and Co., Chicago. - - - - - - - - .40
5. Washington's Rules of Conduct, Diary, Letters, and Addresses, Houghton, Mifflin and Co., Chicago. - .25
6. Wiltse's Jean Valjean, Ginn and Co., Chicago. - 1.05
7. Wiggin's The Story of Patsy, Houghton, Mifflin and Co., Chicago. (Fine) - - - - - - - .60

8. Ball's Star-Land, Ginn and Co., Chicago. - - 1.10
9. Wyss' Swiss Family Robinson, Ginn and Co., Chicago. - - - - - - - - - - - .55
10. Hawthorne's Biographical Stories, Houghton, Mifflin and Co., Chicago. - - - - - - - - .25

EIGHTH YEAR.

1. Lowell's Vision of Sir Launfal, and Other Poems, Houghton, Mifflin and Co., Chicago. - - - .25
2. Two Great Retreats of History, Ginn and Co., Chicago. - - - - - - - - - - - .60
3. Scott's Talisman, Ginn and Co., Chicago. - - .60
4. Lamb's Adventures of Ulyses, Ginn and Co., Chicago. - - - - - - - - - - .35
5. Starr's American Indians.
6. Plutarch's Lives, Ginn and Co., Chicago. - - .55
7. Coffin's Story of Liberty, Chas. Scribner's Sons, New York. - - - - - - - - - - 1.00
8. Long's Ways of Wood Folk, Ginn and Co., Chicago. - - - - - - - - - - .60
9. Stories from English History, by Blaisdell, Ginn and Co., Chicago. - - - - - - - - .50
10. Hawthorne's House of Seven Gables, Houghton, Mifflin and Co., Chicago. - - - - - - - .70

In the preparation of these lists of books and selections, the name of the publisher and the price of the book have been given in most instances. A few which were unknown to the writer have been omitted. In these cases your book dealer in your own town will be able to order the book for you without any additional cost.

## CHAPTER VIII.

### NATURE AND ORIGIN OF NUMBER.

*Nature of Number.*—We shall assume in our studies in method in number that number is a *mental*, or *spiritual*, thing and try hereafter to be consistent with this assumption. In making this assumption in our studies four views of what number is must be considered for the purpose of clearness. These views are as follows:

1. There are those who hold that number is an inherent property of objects.

2. There is a view that number is the relation between magnitudes, or quantity.

3. There is a view that number is the mind's idea of the times one magnitude is applied in measuring another.

4. And lastly, some are to be found who hold that the symbol of the mind's idea of the times one magnitude is applied to another in measuring it is number. This view makes the figures the numbers.

*Illustration.*—Thus 5 apples by the first view is regarded as meaning one, one, one, one, and one separate particular apples, the thing which makes each a one being the unity, or particularity, inherent in the object. Number in this sense is qualitative, for it is qualities which makes each object a one.

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5 apples according to the second view means that the whole quantity of apples is measured by the quantity, one apple, and that the relation between these two magnitudes, is the number.

According to the third view the mind's idea of the relation between these two magnitudes, one apple and five apples, is the number.

The fourth view is that the figure 5 is the number.

The following from McLellan and Dewey's Psychology of Number is suggestive on these points:

"Number is not a property of the objects which can be realized through the mere use of the senses, or impressed upon the mind by so-called external energies or attributes. Objects aid the mind in its work of constructing numerical ideas, but the objects are not number. Nor does the bare perception of them constitute number. A child or an adult may perceive a collection of balls or cubes, or dots on paper, or a bunch of bananas, or a pile of silver coins, without an idea of their number; there may be clear and adequate percepts of things quite unaccompanied by definite numerical concepts. No such concepts, no clearly defined numerical ideas, can enter into consciousness till the mind orders the objects—that is, compares and relates them in a certain way."

The above based upon the genesis of number in the mind is argument against the first view of number presented above.

*Genesis of Number.*—By genesis of number is meant the mental process in which number ideas arise. That is to say, the mind performs certain activities in getting number, and these processes constitute the genesis of number.

This process is as follows: 1. The mind grasps a magnitude as a vague whole. 2. The mind brings into consciousness a smaller magnitude of the same kind. 3. The mind measures the larger magnitude by the smaller. 4. The mind grasps the times the smaller magnitude was applied to the larger in the process of measurement; that is, the mind grasps the number.

*Illustration.*—Suppose the number is 8 ft. The meaning is, that a larger magnitude 8 ft. as a whole has been grasped; then the smaller magnitude 1 ft. has come into consciousness, and that this has been applied eight times in the measure of the larger magnitude.

Or suppose the number is 5 boys. The meaning is, that the larger magnitude 5 boys as a whole has been grasped; then the smaller magnitude 1 boy has come into consciousness, and this magnitude has been applied five times in measuring the larger magnitude.

The following helps on this point: "The idea of number is not impressed upon the mind by objects even when these are presented under the most favorable circumstances. Number is a product of the

way in which the mind deals with objects in the operation of making a vague whole definite. This operation involves (a) *discrimination* or the recognition of the objects as distinct individuals (units); (b) *generalization*, this latter activity involving two subprocesses; (1) *abstraction*, the neglecting of all characteristic qualities save just enough to limit each object as *one*; and (2) grouping, the gathering together the like objects (*units*) into a whole or class, the *sum*."

And from the nature of number presented in the above analysis the author draws the following conclusions concerning the teaching of number:

1. "Number can not be taught by the mere presentation of things, but only by such presentation as will stimulate and aid the mental movement of discriminating, abstracting, and grouping which leads to definite numerical ideas."

2. "It is clear that to promote the natural action of the mind in constructing number, the starting point should be not a single thing or an unmeasured whole, but a group of things or a measured whole. Attention fixed upon a single unmeasured object will discriminate and unify the qualities which make the thing a qualitative whole, but can not discriminate and relate the parts which make the thing a definite quantitative whole."

*Definition of Number.*—From the above study we get the definition of number considered from the viewpoint of the psychology of number. This defini-

tion is as follows: *Number is the mind's idea of the times one magnitude is applied in measuring another.* This seems the most helpful definition of number whether one looks at it from the viewpoint of the genesis of number or from the viewpoint of the way the mind uses its number ideas in the practical affairs of life. It is, to say the least, the best working definition for one in the study of the method of teaching number.

*Origin of Number.*—In the study of the nature and genesis of number the mind's natural mode of forming number ideas was seen. But the question for study here is, What is the reason the mind performs these activities? The mind does not do this without a necessity for it, and this reason, this necessity we want to discover. The study of limitation gives us help on this problem.

*Limitation.*—"If every human being could use at his pleasure all the land he wanted, it is probable that no one would ever measure land with mathematical exactness. There might be, of course—Crusoe-like—a crude estimate of the quantity required for a given purpose; but there would be no definite numerical valuation in acres, rods, yards, feet. There would be no need for such accuracy. If food could be had without trouble or care, and in sufficiency for every-body, we should never put our berries in quart measures, count off eggs and oranges by the dozen, and weigh out flour by the pound. If

every-thing that ministers to human wants could be had by every-body just when wanted, we should never have to concern ourselves about quantity. If everything with which human activity is in any way concerned were unlimited, there would of course be no need to inquire respecting anything whatever: What are its limits? How much is there of it? Even if a thing were not actually unlimited, if there were always enough of it to be had with little or no expenditure of energy, it would be *practically* unlimited, and hence would never be measured. It is because we have to put forth effort, because we have to take trouble to get things, that they are limited for us, and that it becomes worth while to determine their limits, to find out the *quantity* of anything with which human energy has to do."

Limitation is the fundamental idea in all magnitude. If there were no limitations upon things there would be no necessity for measuring magnitudes, and hence no necessity for number.

This same principle may be worked out in another way by considering the relation between means and end. "If all our aims were reached at the moment of forming them, without any delay, postponement, or countervening occurrences—if to realize an end we had only to conceive it—the necessity for measurement would not exist, and there would be no such thing as number in the strictly mathematical sense." But the end to be realized is often remote

and complex so that to realize it distance in space, remoteness in time, and various hindering circumstances must be overcome. In adopting the proper means, quantity, or magnitude, of some kind must be considered, and thus measurement. And from this the necessity of number arises.

"The conscious adjusting of means to end, particularly such an adjusting as requires comparison of different means to pick out the fittest, is the source of all quantitative ideas—ideas such as more and less, nearer and farther, heavier and lighter, etc. Quantity means the valuation of a thing with reference to some end; what is *its worth, its effectiveness*, compared with *other possible means*. These two conceptions—(a) the origin of quantitative ideas in the process of valuation (measuring) and (b) the dependence of valuation upon the adjusting of means to an end are the beginning of all conceptions of quantity and number, and the sound basis of dealing with them."

"Number arises in the process of the exact measurement of a given quantity with a view to instituting a balance, the need of this balance, or accurate adjustment of means to end, being some limitation."

Thus we have reached the following conclusions from our study of the origin of number:

1. There is a limitation upon all things man desires.

2. There is the necessity of adapting means to end in man's life.

3. Out of these conditions there is the necessity for measurement.

4. The necessity in the mind for exact ideas of measurement is the origin of number.

NOTE.—The quotations in this chapter are from The Psychology of Number by McLellan and Dewey.

## CHAPTER IX.

### METHOD OF PROCEDURE IN TEACHING NUMBER.

*Points to Be Kept in Mind.*—In studying the procedure in method in number, there are some points in the theory studied before, to be kept constantly in mind because of the guidance they furnish. Some of these points are as follows:

1. Limitations transform things into quantity, giving them a certain undefined magnitude as size, bulk, weight, time, etc.

2. This vague whole of quantity is changed into definite ideas of quantity through the process of measurement.

3. The process of measuring takes place by means of units of magnitude, the units being put together till they equal the whole in value.

4. The idea of number arises in the mind out of this process of measuring.

5. Number is the mind's idea of the times a unit of magnitude is applied in the process of measuring.

"Number is the product of the mere repetition of a unit of measurement."

Number is the abstract ratio of one quantity to another quantity of the same kind.—Newton.

Number is the ratio of one quantity to another quantity taken as a unit.—Euler.

*Methods in Use.*—There are at any rate the following methods used in primary number work: 1. The method of symbols. 2. The fixed unit method; also, called the method of things. 3. The Grube method. 4. The Speer method.

A brief study of each of these will give some help and so will be undertaken.

*The Method of Symbols.*—This method consists in teaching number as merely a set of symbols. It "is illustrated in the old-fashioned ways—not yet quite obsolete—of teaching addition, subtraction, etc., as something to be done with 'figures,' and giving elaborate rules which might guide the *doer* to certain results called 'answers.' It is little more than a blind manipulation of number symbols." According to this method number is made "the science of figures and the art of memorizing and the rules for manipulating them."

Many a child has studied arithmetic in this way for years without ever having had a right idea of number.

"While *the method of symbols* is still far too widely used in practice, no educationist defends it; all condemn it. It is not then necessary to dwell upon it longer than to point out in the light of the previous discussion *why* it should be condemned. It treats number as an independent entity—as something apart from the mental activity which produces it; the natural genesis and use of number are ignored, and, as a result, the method is mechanical and artificial."

This method subordinates number to the symbol of number. The meaning is subordinate to the form; the spirit that maketh alive to the form that killeth.

This method of merely manipulating figures has not one feature to recommend it.

*Illustration.*—It used to be the practice to teach addition to children by having them to memorize the following rule as the first step:

'*Write the numbers to be added so that figures of the same order may stand under each other, units under units and tens under tens, and draw a line directly beneath.*

*Begin at the right hand side and add each column separately, writing the units under the column added, and carry tens, if any, to the next higher order. At the last column write the last whole amount.*'

After having memorized the rule, the children were led to manipulate the figures in the formal process of addition according to rule.

This is an extreme case of teaching according to the method of symbols.

*The Fixed Unit Method, or the Method of Things.*—This method is founded upon the assumption that the child gets the idea of number by closely observing one object, then another object, and so on. It is evident from our previous studies that the child does not get his ideas of number in this way, so the fundamental assumption of this method is wrong.

This method, "the simple perception or observa-

tion method, depends almost wholly upon physical operations with things. Objects of various kinds—beans, shoe-pegs, splints, chairs, blocks,—are separated and combined in various ways, and true ideas of number and of numerical operations are supposed necessarily to arise."

"The *method of things*—of observing objects and taking vague percepts for definite numerical concepts—treats number as if it were an inherent property of things in themselves simply waiting for the mind to grasp it, to 'abstract' it from the things. But we have seen that number is in reality a *mode of measuring value*, and that it does not belong to things in themselves, but arises in the economical adaptation of things to some use or purpose."

McLellan and Dewey have the following to say about the two methods studied above:

"Both of these methods are vitiated by the same fundamental psychological error; they do not take account of the fact that number arises in and through *the activity of mind in dealing with objects.* The first method leaves out the objects entirely, or at least makes no reflective and systematic use of them; it lays the emphasis on symbols, never showing clearly what they symbolize, but leaving it to the chance of future experience to put some meaning into empty abstractions. The second method brings in the objects, but so far as it emphasizes the objects to the neglect of the mental activity which uses them, it

also makes number meaningless; it subordinates thought (i. e., mathematical abstraction) to things. Practically it may be considered an improvement on the first method, because it is not possible to suppress entirely the activity which uses the things for the realization of some end; but whenever this activity is made incidental and not important, the method comes far short of the intelligence and skill that should be had from instruction based on psychological principles."

This method of things is used largely in almost all parts of the country, and since it is so widely used, number teaching is far different almost everywhere from what it should be. *The mistake is in presuming that the child gets the correct idea of one (a unit) by closely observing one object.* The child's idea of one got in this way is qualitative, and not quantitative. The child does not see the one as any one employed as a quantity with which to measure a larger quantity.

"A *unit* is any standard of reference employed in counting any collection of objects, or in measuring any magnitude." This is certainly the correct idea of a unit numerically considered.

The following quotation from McLellan and Dewey will present the chief objection to this method:

"It (the fixed unit method) does not promote, but actually warps, the natural action of the mind in the construction of number; it leaves the fundamental numerical operations meaningless, and frac-

tions a frowning hill of difficulty. No amount of questioning upon one thing in the vain attempt to develop the idea 'one,' no amount of drill on two such things or three such things, no amount of artificial analysis on the numbers from one to five, can make good the ineradicable defects of a beginning which actually obstructs the primary mental functions, and all but stifles the number instinct."

*The Grube Method.*—"The Grube Method is a method of teaching Primary Arithmetic, extensively used in Germany. The principle of this method is, that it makes each individual *number*, instead of the *operations*, the basis of the instruction; and combines in each lesson, from the start, the four fundamental operations. Thus, in treating the number 2 'all the operations possible within the limit of this number' are performed in the same lesson. Thus, the child is taught that $1+1=2$, $2\times1=2$, $2-1=1$, $2\div1=2$, $2\div2=1$, etc. In teaching the number 4, the lesson is $1+1+1+1=4$, $4-1=3$, $4\times1=4$, $4\div1=4$; $2+2=4$, $2\times2=4$, $4-2=2$, $4\div2=2$; $3+1=4$, $4-3=1$, $3\times1+1=4$, $4\div3=1$, and 1 remaining, etc. The whole circle of operations is exhibited and taught in treating each individual number."

This quotation sets forth pretty clearly the essential idea in the Grube Method. It will be seen that it starts with a fixed unit, and in principle is not substantially different from the Fixed-Unit Method. It has all the faults of the Fixed-Unit Method, and so

is subject to all its criticism. The following quotations will throw some light upon the defects of the Grube Method:

"The unit is never to be taught as a *fixed thing* (e. g., as in the Grube Method), but always as a unit of measurement."

"We thus see the fundamental fallacy of the Grube Method in another light. Just as, upon the whole, it proceeds from the mere observations of objects instead of from the constructive *use* of them, so it works with fixed units instead of with a whole quantity which is measured by the application of a unit of measurement. The superiority of the Grube method to some of the other methods, both in the way of introducing objects instead of dealing merely with numerical symbols, and in the way of systematic and definite instead of haphazard and vague work, has tended to blind educators to its fundamentally bad character, psychologically speaking."

"According to the Grube method unity is one *thing* and that is the end of it."

"Avoid the interest-killing monotony of the Grube grind on the three hundred and odd combinations of half a dozen numbers, which thus substitutes sheer mechanical action for the spontaneous activity that simultaneously develops numerical ideas and the power to retain them."

*Speer Method.*—"The Speer Method in number is one that considers number as a ratio, and not as

'how many' in the usual meaning of that term. In the development of the Speer Method there are three stages: (1) The discovery of qualitative relations of magnitude, i. e., that one magnitude is longer or shorter, larger or smaller, heavier or lighter, etc., than another. (2) The discovery of the quantitative relations of magnitude as expressed by their ratios, i. e., how many times one magnitude is longer or shorter, larger or smaller, heavier or lighter, etc., than another. (3) The determination of the plan of procedure in the solution of problems from the ratios of the magnitude involved."

The Speer Method may be characterized by saying it holds closely and consistently to the idea that all number work must deal with the relations between magnitudes. It starts by having children to compare magnitudes and makes the comparison of magnitudes the organizing idea of all number work. The following pages copied from Speer's "Primary Arithmetic" will give some idea of his method of procedure.

Page 65.

"1. Cut a rectangle into two equal parts. After cutting, place the two parts together to see if they are equal. Practise cutting and comparing the two parts.

2. Cut rectangles into three equal parts. Compare the parts. Are they equal? Practise.

*Drawing.*—1. Draw a line. Place a point in the middle of the line. Measure to see if the parts are equal. Try again. Measure. Is one of the parts longer than the other?

Are they equal? What is meant by equal? Show me one of the two equal parts. Show me the other.

2. Draw a line. Separate it into two equal parts. Measure. Are the parts equal? Show me one of the four equal parts. Show me three of the four equal parts. Show me the four equal parts.

3. Draw a line. Separate it into three equal parts. Measure. Are the parts equal?

4. Show me where the line should be drawn to separate the blackboard into two equal parts. Point to the two equal parts of the board.

5. Can you see the two equal parts of the floor? Of the top of your desk? Show me two equal parts of other things in the room.

Give each pupil a square.

6. Measure the edges of the square. What is true of the edges of the square? Find other squares in the room.''

Page 82–84.

''*Relations of quart and pint.*—Show pupils the pint and quart measure. Have them find the number of pints equal to a quart by measuring.

1. After measuring, tell all you can about the quart and the pint.

2. What is sold by the pint and by the quart?

3. A quart is how many times as large as a pint?

4. What part of a quart is as large, or as much, as a pint?

5. A quart is how much more than a pint?

6. A pint is how much less than a quart?

7. A quart and a pint equal how many pints?

8. Show me 1½ quarts. What have you shown me?

9. 1½ quarts equal how many pints?

10. If we call a pint one what ought we to call a quart? Why?

11. If we call a quart 2, what ought we to call the sum of a quart and a pint?

12. If a quart is 1, what is a pint?

Fill the quart and pint measure with water, and let each pupil lift the two measures.

1. Which is heavier,—the quart of water or the pint?

2. The quart of water is how many times as much as the pint?

3. What part of the quart weighs as much as the pint?

4. The weight of a pint equals what part of the weight of a quart?

5. The weight of a quart equals the weight of how many pints?

6. A pint of water weighs a pound; how much does a quart of water weigh?

7. What part of a quart of water weighs a pound?

8. The sum of a quart and a pint of water weighs how many pounds?

9. Compare the weight of different solids with the weight of a pint of water.

Ex.: This solid weighs less than a pound, or this solid weighs a little more or less than a pound.

10. If a pint of milk costs 3 cts., what ought a quart to cost?

11. In a quart there are how many pints? In three quarts there are how many 2-pints?

12. How much milk should be put into a quart measure to make it half full?"

The ideas of *measurement, comparison*, and *relations of magnitude* are seen to pervade and dominate the whole work.

*What kind of number work is it; good, bad, or indifferent?*

*The Practical Method.*—From the various methods in use in teaching number the teacher must select a line of procedure possessed of the three following characteristics.

1. The method must be *usable* by the teacher of *average intelligence and of average professional preparation.*

2. It must be *systematic—well organized and definite.*

3. It must as nearly as possible be in harmony with *the mind's natural mode of action* in the development of number ideas and number processes.

With these three thoughts before us for guidance we are ready further to study the method of proceeding in teaching number.

The following quotations will give some idea of the way to start:

"The first lessons in arithmetic should be based on the practice of measuring in its varied applications."—W. T. Harris.

"Number grows out of the idea of measurement. This should never be forgotten. It is the abstract character of so much of the number work that makes it uninteresting and unprofitable."—Illinois State Course of Study.

*The Two Stages of Number Work.*—For the purpose of helping ourselves in the study of its method we may very appropriately divide arithmetic, or number, work into two stages, or phases. In a very

general way the first stage consists of about the first three years of work which children are accustomed to do in school. And this stage may be called *primary number work.* The second stage embraces the remainder of the learner's work in arithmetic, or number, in school, and may be called the *advanced stage* of number work.

*Characteristics of Primary Stage.*—This stage of number work is characterized by the following:

1. The work is much more elementary, or simple, than that in the second stage.

2. The work in this stage is to be done best without placing any text-books in the hands of the pupils.

3. The work in this stage is much narrower in scope than that in the second stage.

4. The work in the first stage is much more concrete than that in the second stage, that is, the work is done more by means of objects.

*Scope of Work in Primary Stage.*—In this stage the numbers from one to one hundred inclusive are dealt with generally. It is fair, perhaps, to say that it is customary the country over to confine the number work for the first three years of school mainly to the numbers from 1 to 100, inclusive. The state courses of study for Indiana and Illinois indicate approximately what is done in this stage of the work.

The Uniform Course of Study for Indiana divides the first year's work into three parts as follows:

"First Part.—Numbers from 1 to 4, inclusive."

"Second Part.—Numbers from 5 to 7, inclusive."

"Third Part.—Numbers from 8 to 10, inclusive, and review."

The second year's work is also divided into three parts according to this course of study, as follows:

"First Part.—Numbers from 11 to 13, inclusive, as above."

"Second Part.—Numbers from 14 to 16, inclusive, as above."

"Third Part.—Numbers from 17 to 20, inclusive, as above, and review."

In the third year according to the same course of study Cook and Cropsey's New Elementary Arithmetic is put into the hands of the pupils, and is to be mastered up to and including the 100th page. The work in this book up to this place is mainly on numbers below 100 but some work is done on higher numbers.

The Course of Study for the Common Schools of Illinois provides for about the same amount of work for the first three years as the Indiana Course of Study. The work is as follows:

First Year.—"Number.—From 1 to 10 with combinations."

Second Year.—"Number.—Combinations from ten to twenty with much concrete work."

Third Year.—Arithmetic.—"The work of the year includes the mastery of addition and subtrac-

tion, multiplication, division, and partition to 100, and the measurement of perimeters and areas."

From the above it is seen that the first year's work in number is spent on the numbers from 1 to 10, inclusive; that the second year's work is spent on the numbers from 11 to 20 inclusive; and that the third year's work is mainly spent on the numbers from 21 to 100, inclusive, in Indiana and Illinois by those who follow the State Courses of Study. And since the State Courses of Study are prepared by representative educators of these two states they indicate the consensus of educational opinion more or less approximately.

The object in making the dividing line between the first year's work and second year's work at the number 10, and between the second year's work and the third year's work at the number 20, and between the third year's work and the fourth year's work at the number 100 is arbitrary, no doubt. There is certainly no very good reason for not going further in the first year, or further in the second year, or further in the third year, if the ability of the students, length of the school year, and progress of the students demand it. To make these divisions of the work ironclad is unwarranted either in reason or experience. Much just criticism has been given to such a division of the work.

However arbitrary this division of the number work may be, it has, however, served a useful pur-

pose. And this purpose is that it has systematized and made definite the work of these years. This has been useful to teachers and to students. It has prevented aimless, fragmentary, disconnected work. Indeed, it seems that the thought which gave rise to this division of the work was, that the work might thus be made systematic, definite, and clear.

If the scope of the work in the Primary Stage is the numbers from 1 to 100, inclusive, the next question is, What is to be done with any individual number? What, for instance, is to be done with the number 4 in this first stage of the work? In order to answer this question we need to study what can be known of number, and to this we turn.

*What Can Be Known of a Number.*—A careful analysis will show that the following may be known of a number:

1. *The number as a whole.*

2. *The relations in the number.* These are as follows:

$1^1$. Integral, as follows:

$1^2$. *Any two unequal numbers that make the number*, as in the following problems:

If a boy has five marbles and finds four more, how many has he?

If a book costs four dollars and a trunk five dollars, what do both cost?

$2^2$. *Any two equal numbers that make the number*, as in the following problem:

John earns three dollars in a day, and James earns the same; what do both earn?

$3^2$. *Any two unequal numbers into which the number may be separated*, as in the following problems:

John had six pennies and spent two; how many had he left?

A man spent six of his ten dollars for provisions; how many had he left?

$4^2$. *Any two equal numbers into which the number may be separated*, as in the following problems:

A farmer has eight horses and sells four; how many has he left?

A boy lost five of his ten marbles; how many had he left?

$5^2$. *The number of equal numbers that make the number*, as in the following problems:

A man gives two marbles to each of four boys; how many marbles does he give?

A boy leaves two pints of milk at each of five houses; how many pints does he leave?

$6^2$. *The number of equal numbers that are in the number*, as in the following problems:

A man has eight pints of milk; how many quarts has he?

A teacher wishes to give ten problems to his boys, two to each boy; to how many boys can he give?

$7^2$. *The equal parts of a number*, as in the following problems:

A man divides eight oranges equally among four boys; how many does he give each?

A stationer distributes nine tablets equally among three girls; how many does each receive?

$2^1$. *Fractional*, as follows:

$1^2$. *The equal parts of a number*, as in the following problems:

A boy had eight marbles and lost four; what part did he lose?

A boy had an apple and divided it equally among three other boys and himself; what part did each have?

A farmer had eight horses and six of them died; what part died? what part remained alive?

3. *The applications of the number.*

$1^1$. *Denominate;* as, four pecks in a bushel, or four gills in a pint.

$2^1$. *General Applications;* as, when teaching the number 4, the 4's in the room might be pointed out by the children.

4. *The notation of the number.*

The symbol of the number may be (1) the word or words, as *eight;* (2) the figure, as 8; (3) the Roman letters, as VIII. That is to say, the notation of numbers may be by words, figures, or letters.

*Summary.*—This may be summed up by saying the following may be known of a number:

$1^1$. The number as a whole.
$2^1$. The relations in it.
  $1^2$. Integral.
  $2^2$. Fractional.
$3^1$. Its applications.
  $1^2$. Denominate.
  $2^2$. General.
$4^1$. Its notation.

*What to Do with a Number in the Primary Stage.*—From the foregoing study we see that a number, for instance 4, is to be taught (1) as a whole; (2) as to the relations in it, both integral and fractional; (3) as to its applications, both denominate and general, and (4) as to its notation. This work is to be done with each number from 1 to 10, inclusive, in the first year; from 11 to 20, inclusive, in the second year, and from 21 to 100, inclusive, in the third year. Each of these points will repay further study.

*The Number as a Whole.*—When does the learner know the number as a whole, and how proceed in teaching it? In answer to this question, the learner knows a number as a whole when he knows it as made up of so many *ones*, or again, he knows it as a whole when he knows it as made up of *the next number below it* and *one*. Thus the learner knows the number 4 as a whole when he knows it as made up of four *ones*, or when he knows it as made up of *three* and *one*. And in answer to the second part of the question, one term in the above needs to be studied, and this is the *one*.

*The One, or the Measuring Unit.*—The one in number is not a fixed quantity, but is relative. It indicates that something taken as a measuring unit has been applied to some unmeasured whole once. Thus the one is anything—one inch, one mile, one week, one century, one ounce, one ton, one tree, one boy, one book, one flower—employed as a unit of measure.

The perennial dispute as to whether one is a number seems out of place when this view of one is taken.

This idea of what the *one* is furnishes guidance in teaching a number as a whole; that is, it indicates that the teaching must be done so as to lead the child to see that the ones are so many applications of the measuring unit. This may be done as follows:

If the number to be taught be four, draw a line on the board four feet long; give the child a foot measure and have him measure off three feet, then one more and ask him how long the line is. If he does not know the name of the new number it will have to be given him. Or give the child a pint cup and have him measure three pints of water and put them in a bucket, then one more and ask how many pints of water are in the bucket. Then ask him to show fours of things in the room, or on the table, or tell fours of things he has seen at home or on the road to school. Repeat this kind of work until the learner has the idea of four as a whole well in mind.

The work with any of the other numbers as a whole is to be done in a similar manner.

*The Relations in the Number.*—From the study of the nature of number, and from the study of the meaning of *one*, we also get knowledge valuable for guidance in teaching the relations in number. These studies indicate that these relations shall be taught in such a way as to lead the learner to see that number is always the result of measurement. The measuring idea is always to be made prominent.

In order to make clear the meaning of the *integral relations* in a number, let us arrange the relations in the number 4, as follows:

1. Three and one.
2. One and three.
3. Four minus one.
4. Four minus three.
5. Two and two.
6. Four minus two.
7. Four divided by two.
8. Two twos.
9. Four minus four.
10. Four divided by one.
11. Four ones.

It readily appears that these relations divide themselves into synthetic and analytic relations.

The synthetic are:

1. Three and one.
2. One and three.

3. Two and two.
4. Two twos.
5. Four ones.

The analytic are:

1. Four minus one.
2. Four minus three.
3. Four minus two.
4. Four divided by two.
5. Four minus four.
6. Four divided by one.

It is also evident that *addition*, *subtraction*, *multiplication*, and *division* are all employed in working out the relations in any number.

Now since these relations are to be taught, the question, What shall be the order of teaching the relations? arises. McLellan and Dewey say very pointedly that the relations involving addition and subtraction should be taught first; secondly, the relations involving multiplication; and, lastly, those involving division. The following will show their thought: "The psychological order as determined by the demand on conscious attention is the old-time arrangement—Addition and Subtraction, Multiplication and Division.

It is the order in which numerical ideas and processes appear in the evolution of number as the instrument of measurement; the order in which they appear in the reflective consciousness of the child; the order of increasing growth in psychological complexity."

From the foregoing study, in teaching the relations in a number, the teacher holds in mind a given relation, and so manipulates objects or has the children so manipulate them as to lead them to grasp the relation and state it. In this work the idea of measurement is made prominent, and the order of the relations is, first, addition and subtraction; secondly, multiplication and division.

Help will come from arranging the fractional relations of some number, as of the number 4. They are:

1. Three fourths of four and one fourth of four.
2. One fourth of four and three fourths of four.
3. Four minus three fourths of four.
4. Four minus one fourth of four.
5. Two fourths of four and two fourths of four.
6. Four minus two fourths of four.
7. Four divided by two fourths of four.
8. Two two fourths of four.
9. Four minus four fourths of four.
10. Four divided by one fourth of four.
11. Four one fourths of four.

*The Applications of a Number.*—Upon taking up the study of the applications of a number two kinds of applications will be studied.

1. The applications of a number *in the tables;* that is, the denominate applications.

2. The applications of a number in general.

Under the first the children are to be taught con-

cretely in connection with any number all the units of the tables, which consist of that number; as:

Four inches are one hand.

Four gills are one pint.

Four pecks are one bushel, etc.

The denominate applications of numbers from 1 to 10 are:

1.

One cent.

2.

Two one-cents are two cents.

Two pints are one quart.

Two reams are one bundle.

A sheet folded into two leaves is a folio.

3.

Three feet are one yard.

Three feet are one pace.

Three miles are one league.

Three one-cents are three cents.

4.

Four quarters are one yard.

Four quarters are one dollar.

Four inches are one hand.

Four gills are one pint.

Four pecks are one bushel.

Four quarts are one gallon.

Four weeks are one month.

Four farthings are one penny.

A sheet folded into four leaves is a quarto.

5.

Five one cents are five cents.

6.

Six feet are one fathom.

7.

Seven days are one week.

8.

Eight quarts are one peck.

Eight cord feet are one cord.

A sheet folded into eight leaves is an octavo.

9.

Nine square feet are one square yard.

10.

Ten cents are one dime.

Ten dimes are one dollar.

Ten dollars are one eagle.

Under the general applications of a number, the pupils are required to solve, and to form and solve miscellaneous problems; as:

If a boy buys three apples at one store and one at another store, how many does he buy?

If a man has four oranges, to how many boys can he give two each?

*Notation of the Number.*—Notation may be defined as the science and art of representing numbers by symbols. The symbols used are *words*, *letters* and *figures*. Thus the number 4 may be symbolized by (1) *four;* (2) by IV; and (3) by 4. The first kind of notation may be called *notation by words;* the second

is called the *Roman notation;* and the third, the *Arabic notation.*

At some time during the first three years the notation of numbers from 1 to 100 is taught.

## CHAPTER X.

### METHOD OF PROCEDURE IN TEACHING NUMBER.—CONCLUDED.

*The Primary Stage.*—In an approximately accurate way it may be said that in the primary stage of number work, the numbers from 1 to 100, inclusive, are to be taught, each (1) as a whole; (2) as to the integral and fractional relations in it; (3) as to its denominate and general applications; and (4) as to its notation. Now, this must be understood to mean that most of the work falls within this scope, but that it is not of necessity limited to this scope.

*Time of Beginning.*—There are good reasons for believing it best not to start the child on the number work proper at the beginning of the first year, but that the number work for the first two or three months should be incidental. The following shows one author's thought:

"The work during a period of about three months *in so far as number is concerned is incidental.*

The main idea is to train the mind by a consideration of *form*, as sphere, cube, cylinder, prism, square, triangle, points, etc.

In doing this work number is, of necessity, incidentally introduced and learned."

The nature of this work may be seen from the following:

1. "What is this?

Find other balls, or spheres.

Find a larger sphere than this. Find smaller ones.

2. Name objects like a sphere. * * * *

3. What is the largest sphere that you have seen?

What is one of the smallest spheres that you have seen?

4. To-morrow tell me the names of spheres that you see when going from school and at home.

* * * * * * * *

5. What was the largest sphere you found?

What was the smallest?"

*Finding Colors.*—Tests in color should be given before the formal work suggested below. For example: Group cards of the same color and threads of worsted.

Provide ribbons, worsted, cards, etc., of different colors, to be found by pupils when looking for a particular color.

Pin or paste squares of standard red and orange where they can be seen. Pin the red above the orange.

1. Find things in the room of the same color as the red square. What things can you recall that are red?

2. Look at the orange square. Find the same color elsewhere in the room. Recall objects that have this color.

3. Close your eyes, and picture, or image, the red square. Now the orange square.

4. Which square is above? Which below? Name the two colors.

5. To-morrow bring something that is red and something that is orange. Also tell the names of orange or red objects that you see in going to and from school.

Pin or paste a square of yellow below the orange.

1. Look at the yellow. Find the same color in the room. Recall objects having this color.

2. Look at the red, then the orange, then the yellow. Close the eyes and picture the colors one after another in the same order.

Cover the squares.

3. Which color is at the top? At the bottom? In the middle?

4. Name the three, beginning at the top. Name from the bottom.

5. Which color is third from the top? Second from the top? Third from the bottom?

6. To-morrow bring something that is yellow and tell me the names of things that you have seen that are yellow.

Add a square of green.

1. Find green. Recall objects that are green.

2. Try to see the green square with the eyes closed.

3. Look at the four colors.

4. Think of the four, one after another, with the eyes closed.

Cover the squares.

5. Think the colors slowly from the top down. From the bottom up.

6. Name the colors from the top down. From the bottom up. Which is second from the top? Third from the bottom? Second from the bottom?

7. Which color do you like best?''

Lessons similar in character may be given on magnitudes—the cube, the cylinder, the square, the oblong, the triangle, the circle, the line, the cone, the prism, etc., *the teacher constantly emphasizing sense training and the comparison of magnitudes.*

*The Number as a Whole.*—It will be recalled that the child knows a number as a whole when he knows it as made up of so many ones, or as made up of the first number below it and one. And so when the learner is led to see this he has been taught the number as a whole.

*Illustration.*—If the child is to be taught the number 7 as a whole, we can assume that he knows the number 6. Then we may give him a number of cubes and have him to put six in one place, and one in another place; then have him put them all together, and then ask him how many he has. If he does not know the name of the new number, it should be given him. Next he may put six counters in one place and one in another place, then put them together and tell

the "story." The story is, *six counters and one counter are seven counters.*

The "story" is a term the child is to be taught from the first, just as a matter of convenience in teaching number. The child will learn it at first by imitation, but he will soon grasp its significance.

*Further Illustration.*—More in accord with the idea that number results from measurement is the following: Draw a line on the board. Give the child a foot rule and tell him to measure off six feet, then another foot. Ask him how many feet he measured off. Have him tell the story. It is, *six feet and one foot are seven feet.* Or have the child cut a paper slip six inches long, then another one inch longer. Have him tell the story.

*The Relations in a Number.*—In teaching the relations in a number the integral relations should be taught first and then those involving fractions. These are to be taught concretely; that is, by means of objects, first. There are, though, really three stages in teaching each relation. And these stages are as follows:

1. The teaching of the relation in the presence of the objects. This is called the *sense-preception stage.*

2. The teaching of the relation in connection with objects, though the objects are not present. This is called the *imagination stage.*

3. The teaching of the relation without objects; that is, abstractly. This is called the *abstract stage.*

*Illustration.*—Suppose the relation is 4 and 3 are 7. The teacher has the child to measure off four inches of a line, then three more and asks how many inches have been measured off; or she has the child to put four counters in one place and three in another, then all together and asks how many. This is concrete teaching in the *sense-perception stage*, because the sensuous material is handled by the children as a means in leading them to see the relations in the number.

After having taught the relation, 4 and 3, in this way, the teacher might give the following problem: Three birds are sitting on the fence and four in a tree; if those on the fence should fly into the tree, how many would there be in the tree? Or, a farmer has four bushels of corn in a box and three bushels in a barrel; how many bushels has he in both the box and the barrel?

In these cases the objects are not present, but the child pictures them in his imagination. This is teaching the relation in the *imagination stage.*

But suppose the teacher says to the child 4 and 3 are how many? or, 3 and 4 are how many? the work is purely abstract, and such teaching is in the *abstract stage.*

*Importance of Each.*—The work is important in each of these three phases of teaching the relations

in primary number, and should be intelligently and systematically done.

The first is important because it appeals to the senses of the child, is interesting, and lays a sure foundation for the other two kinds of teaching.

But the child must learn to think when not in the presence of the objects about which he is thinking. If one were able to think only in the presence of objects he would be a slave to his environment; he would belong more to the world of things around him than to himself. So the child needs the work in the imagination stage in order to learn to picture the conditions of problems. And this he needs to learn to do well.

The child needs work in the abstract stage in order to become *skillful* in thinking number relations. When 4 and 3 are presented to the mind it is desirable that 7 come into the child's mind as quick as a flash. And the same thing is desirable concerning other numbers. In order to make the child *skillful* in seizing the relations in numbers thus, he must have much of this abstract work.

*Thoroughness of Work.*—In working with any number, as with the number 6, it is not only not necessary to exhaust the number before taking up the relations in the next number, but not even desirable. To exhaust one number before beginning with the next is to deal with numbers as isolated to too great an extent. Such teaching does not sufficiently em-

phasize the relations between numbers. It further keeps the child upon one thing until it becomes monotonous and uninteresting to him.

The work in dealing with the most important relations in numbers from 1 to 100 *must be varied sufficiently to maintain interest, but must be repeated often enough for the child to so thoroughly fix them in mind that they will come into his consciousness instantaneously when needed.* Nothing is more annoying than for the child to have to stop and count his fingers, or dots, or some other objects in order to know, for instance, how many 8 and 9 are.

*Fractional Relations.*—The work in teaching fractional relations should keep pace approximately with the work in teaching the integral relations. That is to say, if, for instance, the integral relations in the number 4 are being taught, before leaving the number the fractional relations are to be presented through the three stages—the sense-perception stage, the imagination stage, and the abstract stage —as in teaching the integral relations.

*Illustration.*—In starting this work an apple may be separated by a pupil or the teacher into two equal parts, the children being led to see that the parts are equal. Then they are given the name for the parts, if they do not already know it. After they learn the name, *one-half*, the pupils are led to see the following:

One-half and one-half are one.

One less one-half is one-half.

Two one-halves are one.

In one there are two halves.

One-half of one is one-half.

In teaching the fractional relations of the number 3 there are two steps:

1. The teaching of the idea, *one-third.*
2. The teaching of the thirds of three.

The idea, one-third, is to be taught as follows:

Give a child a paper three inches long and tell him to cut it into three equal parts. Then teach him that each part is called *one-third;* then as follows:

One-third and two-thirds are one.

Two-thirds and one-third are one.

One less two-thirds is one-third.

One less one-third is two-thirds.

Three one-thirds are one.

In one there are three one-thirds.

One-third of one is one-third.

Two-thirds of one is two one-thirds.

In teaching the thirds of three the procedure is as follows:

Give the learner three cubes and tell him to show you one-third of them. Then have him tell the story. It is, *one third of three cubes is one cube.* Then the child is to be led to see:

One-third of three is one one.

Two-thirds of three is two ones.

Three-thirds of three is three ones.

One is one-third of three.

Two are two-thirds of three.

Three are three-thirds of three.

The procedure in teaching the fractional relations of other numbers is to be the same as in the teaching of *two* and *three*.

*Important and Unimportant Relations.*—There are numbers whose relations, both integral and fractional, are of much less importance than those of some other numbers. Thus 13, 17, 19, 23, 29, 31, 37, 41, 43 and 47 are some of these numbers, while 10, 12, 14, 15, 16, 18, 20, 21, 24 and 36 are among the more important.

In teaching these less important numbers it would not be necessary nor desirable to teach "all the possible relations" in them. It would not be desirable to spend much time on $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, etc., of 13, but one should teach the thirteenths of 13. Likewise in teaching 16, it would not be desirable to teach the thirds, fifths, sixths, sevenths, ninths, tenths, elevenths, twelfths, etc., of 16, but it would be desirable to teach the halves, the fourths, the eighths and the sixteenths of 16.

*The Measuring Idea.*—By way of emphasis we are justified in repeating that every reasonable effort should be made to keep before the child's mind the idea that number is a result of measurement. So in teaching relations in numbers this idea should pervade the whole work.

*The Denominate Applications.*—By denominate ap-

plications are meant the units of the tables consisting of the various numbers, as 8 quarts are one peck, or 4 gills are one pint. These are to be taught concretely in connection with the various numbers.

*Illustration.*—Thus in teaching the number 2, one denominate application to be taught is, *two pints are one quart.* In teaching this concretely the teacher secures a quart measure, a pint measure, and something to measure. She has a child to take the pint measure and fill the quart measure, noting how many pints it requires. Then the quart measure is filled and emptied into the pint measure, the child noting how many times it fills the pint. In each case the story is asked for. In the first case the story is, *two pints of water are one quart.* In the second case the story is, *in one quart of water are two pints.*

The other denominate applications of two and of the other numbers are to be taught in a similar way, when possible. All are to be made as nearly concrete as possible.

*The General Applications.*—General applications are simply those in the solution of problems found in life. There is no more important part of number work than these problems. A teacher's success in teaching number will depend largely upon his ability to give his pupils *many* good problems—problems not too hard and not too easy. Those that will constantly lead the child to a little stronger thinking.

In connection with every number many of these

little problems should be solved by the students. In this work there is rare opportunity for the teacher to show her skill in leading the pupils to think for themselves. And the learner's growth in applying number to the solution of problems arising in practical life depends almost wholly upon how well the teacher does this work in *general applications.*

It is oftentimes a very heavy task upon teachers to arrange these problems originally for their pupils. This task may be made lighter on teachers by their securing some good teachers' manuals on number, or primary arithmetic. These contain large numbers of problems from which the teacher may draw.

A list of such books will be found at the end of this chapter.

*Illustrations.*—Suppose the number under consideration is 21. The following are some of the problems suitable to the children in the average class in this stage of the work:

1. Some birds were in a tree; 7, which was $\frac{1}{3}$ of them, flew away. How many were there at first?

2. A man sold 14 sheep, which was $\frac{2}{3}$ of what he had at first. How many had he at first?

3. A gardener takes 21 bushels of apples to market, and sells $\frac{1}{7}$ of them. How many does he sell? How many has he left?

4. A man gave 3 children 7 apples each; how many did he give to them all?

5. A little girl has 21 picture cards to give to

her playmates. To how many can she give them, if she gives 3 to each?

6. $\frac{4}{7}$ of 21 are how many?

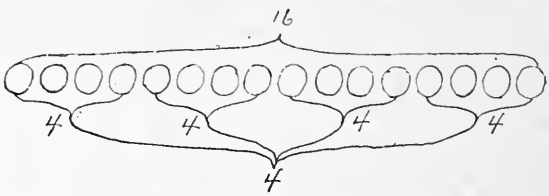
7. $\frac{2}{3}$ of 21 are how many?

8. $\frac{1}{3}$ and $\frac{2}{7}$ of 21 are how many?

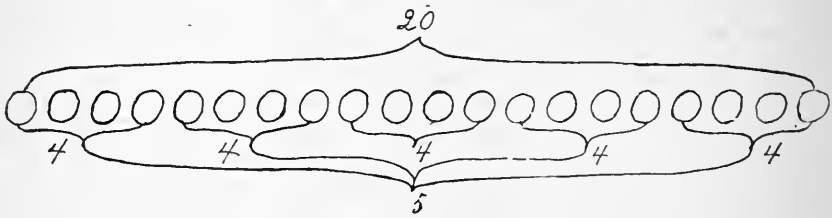
*Picturing Problems.*—This is work to be done by the children at their seats or at the board.

The following will illustrate:

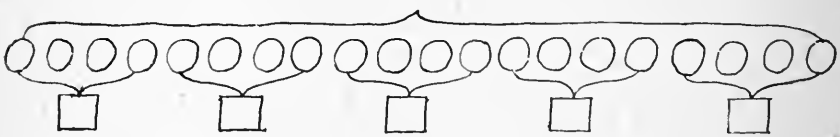
1. How many 4 spheres in 16 spheres?




2. I have 20 cents to spend for picture cards; if I pay 4 cents apiece, how many can I buy?




*or*



This is valuable to children in helping them to see the relations in their problems in the earlier stages of the work. It is easily abused, though, and

carried to extremes. The child should reach a place as soon as possible where he can solve the little problems without the pictures. To carry this work too far would not foster rapidity of thought. As a device, though, properly used it is very helpful to children, and it lightens the work of the teacher.

*Notation.*—Notation may be defined as *systematic number representation.* There are three kinds: (1) notation by means of words; (2) Roman notation; and (3) the Arabic notation. These are all in use more or less, but the most use is made of the Arabic in teaching number.

There is a question concerning when to begin teaching notation, worthy of some study. Some say that the notation of numbers should be taught as soon as the child has ideas of number. And by this is meant that figures are to be taught as soon as the number work begins. Others would not teach notation before the beginning of the second year. One author says: "The fundamental defect in dealing with arithmetic is that *expression* is treated instead of *number.*

This manifests itself in various ways:

1. *In the failure to teach the ideas and oral terms of numbers for a considerable time before beginning the work on written symbols.* In reading, the child has been dealing with ideas and oral terms for six or more years before he begins work upon the written word."

This author, who is a most excellent thinker would not teach the figures before the beginning of the second year.

The one objection against teaching the Roman, and the Arabic notation during the first year is, *that it is difficult to prevent the child from getting a wrong conception of number—the conception that the figures are the numbers.*

The point in favor of it is, that it is convenient in teaching to have the child know the figures the first year, and since he must know them some time, it is just as well to teach them as soon as he gets the number ideas.

It is indeed very unfortunate for the child to get the notion that the figures are the numbers, and every reasonable effort should be made to prevent such a mistake. So, unless the teacher be exceedingly skillful, it is no doubt better not to teach notation till the beginning of the second year.

*Two Stages.*—There are two stages in the process of teaching notation to children. The first consists of the teaching of the notation of the numbers from 1 to 9, inclusive; the second consists of the notation of numbers from 10 to infinity.

*The First Stage.*—The first stage is very simple, and offers very little difficulty in teaching. If notation is not taught until the second year, the following is a good way to proceed:

Draw a line on the board. Tell the child to

measure off six inches. Tell him you are going to place on the board what makes you think six. Write the figure 6 on the board. Tell him to measure one more inch, and you will write what stands for it. Write the figure 7. Or tell him to erase one inch and you will write what stands for what is left, etc.

Point to the figure 6 and let him measure off the number, or point to 5 or 7 and let him measure.

It is evident that this process is much like teaching words as standing for their ideas in reading, and the steps are in general the same. They are:

1. The advance of the mind in rethinking the old number.

2. The advance of the mind in adjusting itself to the figure.

3. The advance of the mind in making the association between the figure and the number.

The following devices will help to make the association strong.

| 0 | 00 | 000 | 0000 | 00000 | 000000 | 0000000 |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | 00000000 | 000000000 | | |
| | | | 8 | 9 | | |
| 0 | 00 | 000 | 0000 | 00000 | 000000 | 0000000 |
| one | two | three | four | five | six | seven |
| I. | II. | III. | IV. | V. | VI. | VII. |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | 00000000 | 000000000 | | |
| | | | eight | nine | | |
| | | | VIII. | IX. | | |
| | | | 8 | 9 | | |

*The Second Stage.*—This is the stage which offers difficulty in teaching, and the teaching well of the work in this stage is of tremendous importance.

In order to form a good basis to work upon here it is well to teach the notation of *ten*, *eleven* and *twelve* in the same way as the notation of numbers from *one* to *nine* were taught. Then one can proceed to teach the principles underlying the notation of these numbers. We want the child to see:

1. That the one ten *resembles* the one unit in being a one, but that it *differs* from it in value.

2. That therefore its symbol should be *like* that for one unit and *different* from it.

3. That the same symbol is used, but that it is different in being *held in the second place by some figure to its right.*

4. That the difference in value expressed by a figure is because of *its position.*

5. That the first place is *ones'*, or *units' place*, and the second is *tens' place.*

The following will indicate how to proceed in teaching: Give the child twelve counters. Ask him how many ones in twelve. Tell him to show you how many tens in twelve and how many ones over. Ask him to write 12 on the board. Ask him if he can see what the figure 2 means; what the figure 1 means. He will readily see that the 2 means two ones, and that the 1 means one ten.

Teach eleven in the same way, using eleven counters.

Have the child write 10 on the board. Ask him what the 1 means; what the 0 means; why it is used.

Ask him if he can now tell you where ones' place is in writing number; where ten's place is.

From this the child should be able to write 13, 14, 15, 16, etc., and tell why he writes them so. If he should have difficulty, work out some more of them concretely; that is, with the counters.

The next point of difficulty will be in the notation of one hundred and numbers above it.

One hundred may be worked out concretely as follows: Give the child 100 counters. Have him divide them into tens by putting little rubber bands around each ten. Have him make them into one hundred by putting a rubber band around the ten tens. Show him he has no tens nor ones to write when he has written the 1 one-hundred. Ask him what to put in tens' place, what in ones' place.

The average child will readily see the notation of one hundred thus.

*Importance of Mastering Notation.*—The notation of numbers both in the science and art phase simply must be mastered in primary number work. The teacher can make no worse mistake in teaching number than to fail to have students thoroughly to understand notation. *It is an impossibility to teach students well the formal processes of addition, subtraction, multi-*

*plication, and division,* if they have not a good understanding of notation. Let the student have well in mind notation, and the teaching of the formal processes of addition, subtraction, multiplication, and division becomes easy. The importance of notation is not likely to be too strongly emphasized.

*Enumeration.*—Enumeration is the reading of number symbols. Some attention will have to be given this in connection with notation. It offers no special difficulty, if notation is well taught.

*The Multiplication Table.*—The question, When and how teach the multiplication table? is one worthy of some study. Many have felt that the old-fashioned way of memorizing it by rote is a very poor way to teach it, and it certainly does kill interest and waste time and energy.

It is evident that if, at the end of the third year, the child has mastered the relations in the numbers up to and including one hundred, he has mastered the multiplication table. For instance, in dealing with four, he learns that $2\times2=4$; in dealing with six, he learns that $2\times3=6$; in dealing with eight, that $2\times4=8$; in dealing with ten, that $2\times5=10$; in dealing with twelve, that $2\times6=12$, and so on. In a similar way he has learned in dealing with six, that $3\times2=6$; in dealing with nine, that $3\times3=9$; in dealing with twelve, that $3\times4=12$; in dealing with fifteen, that $3\times5=15$, and so on. And thus with the numbers, for example, nine. In dealing with nine he learns that $1\times9=9$; in

dealing with eighteen, that $2\times9=18$; in dealing with twenty-seven, that $3\times9=27$; in dealing with thirty-six, that $4\times9=36$, and so on.

From this the hint may be had that the multiplication table is to be taught in connection with the various numbers throughout the entire first three years of the number work.

This does not mean that the multiplication table is *to be taught incidentally;* for *to teach a thing incidentally* usually means to make it of secondary importance and, therefore, to slight it. The multiplication table *must not* be slighted.

The teacher may set about to teach it systematically as follows:

In teaching, for instance, twelve, the table of twos should be learned to twelve; the table of threes, the table of fours, and the table of sixes also should be learned to twelve.

In teaching twenty-four, the table of twos, the table of threes, the table of fours, the table of sixes, and the table of eights should be learned.

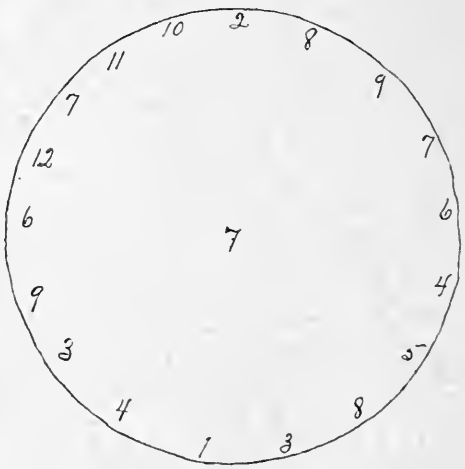
In teaching thirty-six, the table of threes, the table of fours, the table of sixes, and the table of nines should be learned.

In teaching fifty-six, the table of sevens, and the table of eights should be learned.

Enough numbers have been given to show the nature of the work. All other numbers involving the tables should be taught in the same manner.

It is evident that if this work is carefully done, that the opportunities for reviewing the tables are so many that the child will almost surely learn them well. There is, too, a gradual growth, which will lessen the burden of memorizing.

Much drill should be given in order that the association may not be successive. It is very annoying if, for instance, when the child wants to know $7 \times 7$, he must repeat the table of sevens up to that place to get the number 49. It is desirable for 49 to come into his consciousness instantly when he wants the product of $7 \times 7$. The following device is helpful in this work:




The seven in the center of the circle may be changed to 2, 3, 4, 5, 6, 8, or 9.

*Teachers' Helps.*—The following are among the most helpful books for teachers on the subject of primary number:

1. Wentworth and Reed's Primary Arithmetic, Ginn and Co., Chicago.

2. Cook and Cropsey's Elementary Arithmetic, Parts I. and II., Silver, Burdett and Co., Chicago.

3. Speer's Primary Arithmetic, Parts I. and II., Ginn and Co., Chicago.

4. Pierce's First Steps in Arithmetic, Silver, Burdett and Co., Chicago.

5. The Werner Arithmetic, Book I., the Werner Co., Chicago.

## CHAPTER XI.

### PROCEDURE IN THE SECOND STAGE.

*General Scope.*—In this stage of number, or arithmetic, work, is included all the work the child does in school in arithmetic beyond the work in what has been called the primary stage. In this stage are to be taught the formal processes of *addition*, *subtraction*, *multiplication* and *division*. *An intense study of denominate numbers* is to be made. *Fractions* both *common* and *decimal*, *percentage* in its applications, *ratio*, *proportion*, *etc.*, are also taught.

It will be our purpose to study the method of only the elementary parts of this work. The method of the advanced parts of arithmetic, however valuable, is beyond the scope of the present studies.

*The Formal Process of Addition.*—The child has been dealing with addition for something near three years now, but not as a formal process. This will not be difficult for him now.

There are two stages in teaching this, as follows:

1. The teaching of those problems in which the sum of the addends in any order does not equal ten.

2. The teaching of those problems in which the sum of the addends in any order equals or exceeds ten.

123+234+522 illustrates with a problem in the first stage, and 2896+8637+231 illustrates with a problem in the second stage.

*The First Stage.*—This is quite simple, and easily taught, because it does not involve the idea of reduction. The method of teaching is as follows: Send the pupil to the board and tell him to write twenty-five; then tell him to write under twenty-five thirty-two. Ask him to add the five and the two. Ask him what his five is, and what his two is; then what his seven is. Tell him to write the seven where he thinks it belongs. If he does not get it in the right place, show him where it is *customary* to write it. Now lead him to see by questions that the two and three are tens. Have him add them, and ask if he knows where to write the five and why. Then ask him how many twenty-five and thirty-two are.

If the child understands this problem, he will solve the next one without help. Give him a goodly number to fix well in mind the form of such problems.

*The Second Stage.*—This stage is more complex and offers more difficulty in teaching, because, it involves the idea of reduction. The method of teaching is as follows:

Tell the pupil to write on the board or slate or note book fifty-six. Tell him to add to it thirty-four. Lead him by questions to see that the six and the four are ones; then that their sum is ten ones. Lead him to see that his one is one ten and must be put in tens

place, and that he has only naught to put in ones' place. Let him write the one in tens' place and the naught in ones' place. Lead him by questions to see that the five and the three are tens; that their sum is eight tens. Let him write it in tens' place. Then show him that *for convenience* the one ten is not written but held in mind and added to the three and the five tens, and the sum of them all is written.

From this start problems gradually increasing in length and difficulty are given and solved, the reason for each step being obtained from the students by the questions of the teacher.

A place will soon be reached where it will be desirable to give the names and work out the meaning of the terms—*addend* and *sum*—used in addition; also the principle that *only like numbers can be added.* These if taught in the best way possible, will be taught *inductively.*

It is to be noted that the old erroneous notion of "carrying to the next higher order" is entirely unnecessary, and easily avoided when addition is rightly taught.

*The Formal Process of Subtraction.*—The learner has been solving subtraction problems for three years now, but not the formal process of subtraction. Having learned notation well he now has a good basis for subtraction as a formal process.

As in addition, there are two stages in teaching this process, as follows:

1. The stage in which those problems in the subtrahend of which the number in any order is smaller than the number in the minuend in the same order, are taught.

2. The stage in which those problems whose minuend has a number in any order smaller than the number in the same order of the subtrahend.

4867—2534 illustrates with a problem of the first stage, and 2365—1758 illustrates with a problem of the second stage.

*The First Stage.*—This stage offers very little or no difficulty in teaching because of its simplicity. The method of teaching it is something as follows:

Let the pupil write on the board or his slate or on note paper, for instance, 875 and under it 352 and tell him to subtract one from the other and write the result where it should be written. From what he has learned in notation and addition he will almost surely catch the idea in the first problem. Then all that is necessary is to give him a number of problems gradually increasing in difficulty.

*The Second Stage.*—In this stage the pupil will encounter a real difficulty, because it is made somewhat complex by the reduction involved.

The method of teaching should be somewhat as follows: Tell the student to place 34 on the board and subtract 18 from it. He will know that 18 may be taken from 34, but he comes face to face with a difficulty to start with; namely, he can

not take 8 from 4. The teacher now may lead the child to see what to do, concretely. Give the learner 34 counters, and tell him to make them into tens. He makes them into 3 tens and places a rubber band around each ten. Lead him to see that the 34 is the symbol of the 3 tens and 4 ones. Now ask him to take away 8 one-counters. In order to do this he must change 1 ten-counters into ones. Then ask him how many tens he has and how many ones. Have him remove the 8 ones, and write on the board the number of ones he has left. Ask him how many tens he has left. Tell him to take away one ten and write on the board the number of tens he has left.

In this concrete way the pupil learns that when the number in any order in the minuend is smaller than the number of the same order in the subtrahend the subtraction is performed by first reducing one unit of the next higher order to units of this lower order, and then taking away the number in the subtrahend from all the units of that order.

If necessary, other problems may be solved in this concrete way. Then the further work will consist in having the pupils to solve problems gradually increasing in length and difficulty, and the learning of the terms employed in problems in subtraction. These terms may be taught inductively, and will be so taught in work of the best kind.

It is worthy of note that, if subtraction be taught in this rational manner, there arises no necessity for

introducing the fiction of "borrowing and paying back."

*The Formal Process of Multiplication.*—As in the formal process of addition, and subtraction, the pupil should now be well prepared for multiplication as a formal process, since he has been solving little problems in multiplication for some three years.

There are in this work also two stages, as follows:

1. That stage in which problems whose multiplier consists of but one order are solved.

2. That stage in which problems whose multiplier consists of more than one order are solved.

*The First Stage.*—This stage offers very little, if any, trouble in teaching, if the work up to this place has been reasonably well done. The following is a very good way to proceed in teaching it:

Ask the child to write 125 on the board and write 7 ones under it and draw a line beneath. Ask him how many $7\times5$ are, and have him write the result in the proper order. Then have him write the result of $7\times2$ in the proper order; then, the result of $7\times1$ in the proper order. At this stage of the work the form is:

$$\begin{array}{r} 125 \\ 7 \\ \hline 35 \\ 140 \\ 700 \end{array}$$

Now, ask how the result may be written so as to appear as one number. If he can not see, he will

have to be shown, since the form is purely a matter of convenience.

Further work on more difficult problems is then to be given.

The learner should also understand that a problem of this kind is a problem in multiplication.

*The Second Stage.*—This phase offers some points of difficulty in teaching, but will not be very difficult if the work as indicated in these studies has been done moderately well up to this place. The method of teaching is as follows:

Ask the pupil to multiply, for instance, 236 by 24. He will probably not see how to multiply by so large a number. Lead him to see that he can multiply by 4. This he will readily do since it is like the work he has been doing in the first stage of multiplication. Next he is to be led to see how to multiply by the 2 tens. He knows that $2 \times 6 = 12$, but he must see that it is 12 tens. This he will see when he is led to see that 2 tens times 6 ones is 12 tens. He is told to write the 12 tens where it belongs. Let him fill out ones' place with a naught. The next step is to lead him to see that 3 tens multiplied by 2 tens gives 6 hundreds. Let him write the product where it belongs and fill out the places with naughts. And lastly he must be led to see that 2 hundreds multiplied by 2 tens gives 4 thousands. Let him write the result again where it belongs and fill out with naughts. Now he is to be led to see that to get the numbers all together in the

product he must add. The form of the above solution is as follows:

$$\begin{array}{r} 236 \\ 24 \\ \hline 944 \\ 120 \\ 600 \\ 4000 \\ \hline 5664 \end{array}$$

The next step is to lead the pupil to see how to shorten the form by writing as one number 120, 600, and 4000 and that in this case it is not necessary to write the naught in ones' place, since we can tell what the 2 is by its being under 4 tens. So the form is shortened to the following:

$$\begin{array}{r} 236 \\ 24 \\ \hline 944 \\ 472 \\ \hline 5664 \end{array}$$

The learner will usually catch the idea from the first problem. Then the further work consists of the solution of problems of various numbers gradually increasing in difficulty. From the above the teacher should see how to teach such problems as $876 \times 40$, and $8002 \times 402$. No new principles are involved.

*The Formal Process of Division.*—There are two stages in teaching the formal process of division:

1. What is commonly called *long division.*
2. What is usually called *short division.*

*The Order of the Stages.*—There is some difference

of opinion as to which should be taught first, long division or short division. There are, no doubt, successful teachers who begin with short division and also successful teachers who begin with long division.

It may be said truthfully that any abridged form is usually more difficult than the full form for any process. Now short division is an abridged form and should therefore properly come after the full form is known. It probably makes long division more difficult for children, to teach short division first.

*The First Stage.*—After the learner has had the work up to this place as indicated in these studies he should be in such an attitude that he will want to see the reason for each step in any problem. The formal process should be taught in harmony with this idea. The method of teaching is somewhat as follows:

Place on the board for instance, 456 and place the divisor 3 in its position, and tell the pupil you want to find how many threes in 456. Ask how many threes in 4. When the pupil says 1, tell him where you will place it, and put it there. Now he must be led to see that 4 is four hundreds and so the 1 is one hundred. Ask him to show that the 1 is one hundred, and place the two naughts to the right. Then the pupil will have to be shown that the 3 is multiplied by 100 and the product written under 456, and then subtracted from it. The teacher now asks the child if there are any 100 threes in 156. The next step is to lead the child to give the number of threes in 15, and to see

that the 5 is 5 tens. Then multiply across and subtract. Lead him to see that the threes in 6 are 2 of ones order. The form now stands as follows:

```
3)456(100
  300  50
  156   2
  150
    6
    6
```

Now ask the pupil how many threes in 456, and lead him to see how the quotient may be written as one number.

Tell him this is called a problem in division. Now give him a small problem to solve, for instance, $32 \div 2$. Lead him to give reasons for each step. Have him to solve many problems increasing in difficulty. When he begins to get skillful to some extent show him how the form is further shortened by, instead of writing the two naughts at the right of the 3, just the three is written under hundreds and that the same is true of 15, and that the 5 and the 6 are brought down only as needed. The shortened form is then as follows:

```
3)456(152
  3
  15
  15
    6
    6
```

Now give the learner problems gradually increasing in difficulty to solve according to the shorter form.

*The Second Stage.*—The teaching of short division

will now be very easy. It is evident that it is only a further shortening of the form. Using the same problem, for example, show the learner how the form may be further shortened into short division in the case of easy problems. Then give him plenty of suitable problems to solve by the shortest form, and all will be well.

*Conclusion.*—After having mastered the four fundamental processes, the child is ready to study the various applications of these in the arithmetic work proper.

It is beyond the scope of these studies to investigate the method of teaching these various applications. One or two general principles may be laid down however, to guide in this work.

*The relations among the various arithmetical processes should always be made plain, and emphasized.* For example, if in beginning addition of denominate numbers it is shown that not a new principle is involved; that it was all learned in addition of simple numbers, the whole subject at once becomes clear.

2. *In the solution of any problem the pupil should always be led to see just what is given and what is to be found,* before attempting the solution.

## CHAPTER XII.

### THE SUBJECT-MATTER AND PURPOSE OF NUMBER.

*General Nature of Subject-Matter.*—It will be remembered that subject-matter in any subject consists (1) of the facts in the subject, and (2) of the relations among those facts peculiar to that subject alone.

Accordingly we can say that *the subject-matter of number is, in general, the facts a pupil must learn, to know number, together with the proper relations of these facts to each other.*

A closer study here will show (1) what these facts of number are, and (2) what the relations in which they are to be considered are. The facts to be mastered in number study are *the number series*, or *the number continuum.* That is to say, the facts to be mastered in the study of number are the numbers from one to infinity. The number continuum, or the number series, consists of the numbers from one on, including one, of course.

And the relations in which these numbers are to be studied are those indicated in our previous study. They are:

1. The numbers *as wholes.*
2. The numbers *as to what they are made up of and what they may be separated into.*

3. The numbers *as to their notation.*

4. The numbers *as to their denominate and general applications.*

From the above we get the following definite statement for the subject-matter of number: *The subject-matter of number is the numbers in the number continuum each (1) as a whole; (2) as to its notation; (3) as to what it is made up of and what it may be separated into, and (4) as to its denominate and general applications.*

*The Purpose of Number.*—It will be remembered that the purpose of any subject is to be determined from the effect the pursuit of that subject has on the mind. Now the pursuit of number as a subject, like the pursuit of any other subject, affects the mind in two general ways, as follows:

1. By the pursuit of number the pupil gets knowledge valuable for guidance in living. This is called the knowledge-giving purpose.

2. The pupil's mind gets exercise, and by means of this exercise the mind grows in ability to think accurately and readily. This is the disciplinary purpose of the study of number.

*The Knowledge-giving Purpose.*—Some subjects hold their places in the school curriculum because of their knowledge-giving value mainly, while others hold their places in the school curriculum because of their disciplinary value mainly. Number is a subject in the school curriculum mainly because its pursuit

gives useful knowledge. This knowledge is such that it gives the learner the ability to grasp *definitely* a world of quantity that would otherwise remain a vague whole to him. Thus a knowledge of number gives guidance wherever the mind has occasion to measure any kind of quantity. Occasion arises mainly for the measure of quantity in one's business, or industrial, life and in the pursuit of some of the sciences.

*The Guidance a Knowledge of Number Gives.*—As just indicated a knowledge of number gives guidance in the industrial life of a people and in the development of some of the sciences.

It helps here for us to consider what people who are engaged in industrial life do. They are chiefly employed in the following three lines:

1. The production of commodities.
2. The preparation of commodities.
3. The distribution of commodities.

By production of commodities is meant the production of corn, wheat, oats, barley, hay, cattle, hogs, poultry, wool, flax, hemp, fruit, cotton, coal, stone, iron, silk, etc.

By preparation of commodities is mainly meant the manufacture of such things as can better be used in some other form than the original.

Distribution of commodities means the process of sending them from place to place—to the points of consumption.

A knowledge of number does not give a very great amount of guidance in the first line of these activities—the production of commodities. However it gives some. The seasons of the year are to be noted, and measurements of time, etc., are to be made. A knowledge of number guides in all these things.

The preparation of commodities would simply be an impossibility without the guidance which a knowledge of number furnishes. In preparing products constant need of measurement arises. The machinery employed in manufacture, on the farm, and in mines, etc., could never be made without the measurement of quantity. A knowledge of number alone furnishes guidance in these measurements.

In the distribution of commodities a knowledge of number again furnishes much guidance. Things can not be distributed without the exchange of commodities. And in exchange the need for the measurement of quantity is constant. There could be no traffic, no buying or selling without measurement of quantity. The knowledge of number furnishes guidance in all kinds of exchange.

The distribution of things requires railroads and their equipments, steamboats, steamships, the dredging of rivers, docks, canals, etc., none of which can be made without the guidance the knowledge of number gives in measuring quantity.

In the sciences of astronomy, physics, chemistry, geology, etc., a knowledge of number is constantly

needed. It is safe to say that the natural sciences could never have reached the degree of development to which they have attained without a knowledge of number having supplemented them.

This study should realize to us that, when it is said that *the main purpose of number is to give the child knowledge which will enable him to make a vague whole of quantity definite in his effort to think the external world*, the statement is much more comprehensive than one would at first suppose.

*The Disciplinary Purpose.*—While the disciplinary value of the study of number is considerable, it is now believed that it has been overestimated. The following from W. T. Harris will indicate something of this thought:

"The true psychological theory of number is the panacea for that exaggeration of the importance of arithmetic which prevails in our elementary schools. As if it were not enough that the science of number is indispensible for the conquest of Nature in time and space, these qualitative-unit teachers make the mistake of supposing that arithmetic deals with spiritual being as much as with matter; they confound quality with quantity, and consequently mathematics with metaphysics. Mental arithmetic becomes in their psychology 'the discipline for pure reason', although as a matter of fact the three figures of the regular syllogism are neither of them employed in mathematical reasoning."

The study of number gives exercise in memory, imagination and reasoning. It is not particularly good to develop the memory or the imagination, but it is said to be most excellent to cultivate reasoning.

Now it is true that the study of number develops reasoning, but it is worth while to inquire what kind of reasoning. Number study cultivates mathematical, or necessary, reasoning, but the reasoning the learner will need most in life is not of this kind. The learner will need the kind of reasoning developed by the study of the natural sciences, history, and literature—*probable reasoning*—much more than mathematical, or necessary, reasoning.

It is certainly true that the value of mathematics from a disciplinary view point has been overestimated.

*Conclusions.*—Our study of the purpose of number leads to the following conclusions:

1. The knowledge-giving purpose is the main purpose of number study.

2. The knowledge-giving purpose is, to endow the learner with knowledge which will give guidance in making a vague whole of quantity definite in his effort to think Nature in time and space.

3. That this is an entirely sufficient reason for studying number.

4. That while the study of number gives mental discipline, its value from this point of view is commonly overestimated.

## CHAPTER XIII.

### COMMON ERRORS IN TEACHING NUMBER.

*Prevalence of.*—Number teaching offers opportunities for many errors in teaching, and since so many of the teachers in our primary schools begin teaching without having studied the method of teaching number, many flagrant errors are, no doubt, made in the work as commonly done. Some of these errors will be enumerated and studied because of the help that comes from such study. The following are some of these errors:

1. Children are taught the wrong conception of number.

2. Figures are taught instead of number.

3. Number is taught in an unorganized, unsystematic, purposeless way.

4. The formal processes of addition, subtraction, multiplication, and division are taught too early, and too much from the formal side.

5. Children are not properly led to picture the conditions of problems before attempting to solve them.

6. Too much formal drill is done on one number in the effort to exhaust it before taking up others.

7. The relations among the various topics in number are not sufficiently brought out and emphasized.

*Wrong Number Concepts.*—It is fair to say that more than seventy-five per cent. of persons who have studied number for years either have no *definite* idea of number or have a wrong idea of what number is. Perhaps the two wrong notions of number most generally held are (1) that number is a quality of objects; and (2) that the symbols of number—the figures—are the numbers. These two concepts of number are got by children because of the kind of teaching that is done.

The kind of teaching that gives children the first one of these wrong number ideas is that which starts by having the child to closely observe some one thing in order that he may have the idea of *one;* and to closely look at another one thing in order that the idea *two* may arise in mind; and so with the ideas *three, four, five,* etc.

The kind of teaching from which children get the second one of these erroneous number ideas is that of dealing with figures from the first. The plan by which children are given little problems to solve on the board or on slates or on note books in the early work is almost sure to give children this idea of number. Such problems as the following do this thing for children: 2+3, 4—2, 6÷3, 4—3, 2+2, and 4÷2.

*Figures instead of Number.*—One author says the

following on this point: "The fundamental defect in dealing with arithmetic is that *expression* is treated instead of *number*. Symbol is taught instead of substance."

Dealing with figures instead of numbers is formal in the extreme and places the mind's emphasis wholly upon the symbol without its being made clear to the child what is symbolized. It is like his learning to repeat words without knowing their meaning. It is the kind of work that wholly fails to call forth the natural activity of the mind in learning number. Work of this kind—dealing with symbols without getting their meaning—is the mental food which gives intellectual dyspepsia.

*Unsystematic Number Teaching.*—Much number teaching in the past and some of it even in the present has been and is almost useless because of its unsystematic, fragmentary character. Teachers have oftentimes not known what the child can do in number, what he knows of number when he comes to school, nor when and why he should begin number work; in short, they have had no systematic plan thought out to pursue in teaching number. This condition of things must be more or less common when so many of the teachers of the country attempt to teach number without having studied its method. And it will certainly continue to exist so long as there are so many teachers who either do not have the opportunity to study method in number or do not appreciate the necessity of studying it.

The evil of such fragmentary, scrappy work in number is that it is more or less purposeless; it wastes time and energy; it does not discriminate between the important and the unimportant; it is uninteresting and gives the pupils undesirable habits of thought.

*Teaching the Fundamental Processes from the Form Side.*—The formal processes of addition, subtraction, multiplication, and division are not without reason. The form in addition and the others is founded on thought, but so often to the pupil as usually taught the form is purely without reason. Pupils who are sufficiently developed to study these formal processes may be led to see the reason for each step, and they should by all means be taught so they may do so. Teaching the formal processes of addition, subtraction, multiplication, and division as mere form is responsible for the senseless jargon of "carrying to the next higher order" in addition, and of "borrowing one from the next higher order" in subtraction.

The formal, meaningless manner in which the formal processes of addition, subtraction, multiplication, and division have been taught, and are still taught is one of the worst errors, in my judgment, common in number teaching.

*Failure to Lead Children to Picture Problems.*—There is no way for children to solve intelligently many problems which come up for solution except by picturing the problems. Children make ludicrous mis-

takes in their number work because of a failure to picture their problems. A child solved the problem, "If 2 men can build a fence in 10 days, how long will it take one man to build it?" as follows: "If two men can build the fence in ten days, one man can build the fence in one-half of ten days, or in five days." No child who pictured the problem would ever make such a blunder. If children are to be led to see just what is given and just what is to be found, and no child should ever solve a problem without doing so, they must be led into the habit of picturing the conditions of their problems. The advantage in such work is that it promotes clear, accurate, ready habits of thought.

*Exhausting a Number.*—The habit of taking up one number, for instance 4, and just "wearing it out" before doing any work with the succeeding number is condemned by some of our foremost educators in the strongest terms. To keep the learner so long on one number is not only uninteresting and monotonous but is positively injurious to the child. It results in arrested development, and gives him a dislike for the subject of number. It is certainly in direct violation to the mind's natural action in learning number.

*Relations among Topics.*—It is quite customary for teachers to teach the various topics, as division, ratio, fractions, addition and subtraction of simple numbers, addition and subtraction of compound numbers, etc., as isolated. This is a grave error, for thinking

mathematically is only comparing numbers and processes and discovering their likenesses and differences; that is, tracing out relations. Nothing else so well reveals the nature of the various topics in number work as to compare them, and trace out the relations among them. A failure to do this results in the student's failure to see number as an organic whole. He rather gets the idea that the various topics are not essentially related.

*Thoughts of Others.*—A careful study of the following quotation from McLellan and Dewey's Psychology of Number will well pay any student of method in number:

"Since then, the natural action of the child's mind in gaining his first ideas of number is attended with interest, it seems clear that when under the formal teaching of number that interest, instead of being quickened and strengthened, actually dies out, the method of teaching must be seriously at fault. The method must lack the essentials of true method. It does not stimulate and cooperate with the rythmic movement of the mind, but rather impedes and probably distorts it. The natural instinct of number, which is present in every one, is not guided by proper methods till effective development is reached. The native aptitude for number is continually baffled, and an artificial activity, opposed to all rational development of numerical ideas, is forced upon the mind. From this irrational process an arrested development

of the number function ensues. An actual distaste for number is created; the child is adjudged to have no interest in number and no taste for mathematics; and to nature is ascribed an incapacity which is solely due to irrational instruction. It is perhaps not too much to say that nine-tenths of those who dislike arithmetic, or who at least feel that they have no aptitude for mathematics, owe this misfortune to wrong teaching at first; to a method which, instead of working in harmony with the number instinct and so making every stage of development a preparation for the next, actually thwarts the natural movement of the mind, and substitutes for its spontaneous and free activity a forced and mechanical action accompanied with no vital interest, and leading neither to acquired knowledge or developed power."

"Avoid what has been called the 'fixed-unit' method. No greater mistake can be made than to begin with a single thing and to proceed by aggregating such independent wholes. The method works by fixed and isolated unities towards an undefined limit; that is, it attempts to develop accurate ideas of quantity without the presence of that which is the essence of quantity—namely, the idea of *limit*. It does not promote, but actually warps, the natural action of the mind in its construction of number; it leaves the fundamental numerical operations meaningless, and fractions a frowning hill of difficulty. No amount of questioning upon one thing in the vain

attempt to develop the idea of 'one', no amount of drill on two such things or three such things, no amount of artificial analysis on the numbers from one to five, can make good the ineradicable defects of a beginning which actually obstructs the primary mental functions, and all but stifles the number instinct.

Avoid, then, excessive analysis, the necessary consequence of this 'rigid unit' method. This analysis, making appeals to an undeveloped power of numerical abstraction, becomes as dull and mechanical and quite as mischievous in its effects as the 'figure system', which is considered but little better than a mere jugglery with number symbols.

Avoid the error of assuming that there are exact numerical ideas in the mind as a result of a number of things before the senses. This ignores the fact that number is not a thing, not a property nor perception of things, but the result of the mind's action in dealing with quantity. Avoid treating number as a series of separate and independent entities, each of which is to be thoroughly mastered before the next is taken up. Too much thoroughness in primary number work is as harmful as too little thoroughness in advanced work.

Avoid on the one hand the simultaneous teaching of the fundamental operations, and on the other hand the teaching which fails to recognize their logical and psychological connection.

Avoid the error which makes the 'how many'

alone constitute number, and leaves out of account the other coordinate factor 'how much'. The *measuring* idea must always be prominent in developing number and numerical operation. Without this idea of measurement no clear conception of number can be developed, and the real meaning of the various operations as simply phases in the development of the measuring idea will never be grasped.

Avoid the fallacy of assuming that the child, to know a *number*, must be able to picture all the numbered units that make up a given quantity.

Avoid the interest-killing monotony of the Grube grind on the three hundred and odd combinations of half a dozen numbers, which thus substitutes sheer mechanical action for the spontaneous activity that simultaneously develops numerical ideas and the power to retain them."

*Conclusion.*—In conclusion it may be repeated that the idea of measurement is to pervade and dominate the entire number work. This to the end that the child may grow unconsciously into right conceptions of number and numerical operations.

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